A63 Castle Street Improvement, Hull

Scheme Number: TR010016

6.13 Assessment of Implications on Europeans Sites (Habitat Regulations Assessment) Screening Report – No Significant Effects

APFP Regulation 5(2)(q)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

Volume 3

September 2018

Page left intentionally blank

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

A63 (Castle Street Improvement, Hull) Development Consent Order 20[ ]

ASSESSMENT OF IMPLICATIONS FOR EUROPEAN SITES

Regulation Number:	Regulation 5(2)(q)
Planning Inspectorate Scheme Reference	TR010016
Application Document Reference	TR010016/APP/6.13
Author:	A63 Castle Street Project Team

Version	Date	Status of Version
Rev 0	September 2018	Application Issue

Page left intentionally blank

A63 Castle Street Improvement, Hull

Assessment of the Implications on European Sites (Habitat Regulations Assessment) Screening Report - No Significant Effects

TR010016/APP/6.13
HE51408-MMSJV-EBD-S0-RP-LE-000012
14 September 2018

A63 Castle Street Improvement, Hull

Assessment of the Implications for European Sites (Habitat Regulations Assessment)

Screening Report - No Significant Effects

Revision Record

Rev No	Date	Originator	Checker	Approver	Status	Suitability
P01.1	04.09.18	D Wood / A Sadler	BDB	J McKenna		For review
P01.2	06.09.18	D Wood / A Sadler	BDB	J McKenna	Shared	S4
P01	14.09.18	D Wood	BDB	J McKenna	Shared	S4

Prepared for:
Highways England
Lateral
8 City Walk
Leeds
LS11 9AT

Prepared by:
Mott MacDonald Sweco JV
Stoneham Place, Stoneham Lane
Southampton, Hampshire
SO50 9NW

Contents

Appendix F: Noise and Vibration Technical Note

Appendix G: Air Quality Modelled Receptor Locations

1. Introduction

1.1 Background

1.1.1 Highways England is applying for a Development Consent Order (DCO) to carry out improvements to the A63 Castle Street in Hull (the Scheme). The Scheme is a Nationally Significant Infrastructure Project (NSIP) and therefore requires an application to the Planning Inspectorate (PINS) for a DCO. Information on the Scheme can be found on Highways England's website[1]. An Environmental Impact Assessment (EIA) of the Scheme has been carried out and an Environmental Statement has been submitted as part of the Application.

1.1.2 An Assessment of the Implications for European Sites (AIES) must be submitted with the DCO application as parts of the Scheme are within 2km of a European Site (Humber Estuary Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site – see Section 2). For background information, an AIES Screening Report was completed on behalf of Highways England (Highways Agency) in September 2014 for a preliminary design of the Scheme which included the construction of Princes Quay Bridge. This Screening Report underwent required consultation with Natural England over potential pollution pathways. At the time, it was concluded that there would be no significant effects as a result of the Scheme.

1.1.3 It is intended that the construction of one part of the Scheme, the Princes Quay Bridge, may be commenced prior to the DCO being made. The bridge would provide a crossing over the A63 for pedestrians, cyclists and disabled users near to Princes Dock Street and Humber Dock Street. To enable the early development of this part of the Scheme Highways England have applied for, and obtained, planning permission for these works under the Town and Country Planning Act 1990.However, the Princes Quay Bridge remains part of the application for a DCO for the Scheme because construction of the bridge under the existing permission remains subject to the conclusion of consensual land agreements with affected landowners, approval of planning conditions and also to the grant of a marine licence by the Marine Management Organisation (MMO). If the implementation of the existing planning permission is significantly delayed (thus threatening the construction timetable for completion of the greater A63 Scheme) then Highways England will use powers granted under the DCO to construct the Princes Quay Bridge. As the location of the proposed Princes Quay Bridge is within 2km of the European Site, a separate AIES for Princes Quay Bridge was required and submitted in support of HE's planning application in July 2018 (this document was referred to as a Habitat Regulations Assessment (the 2018 HRA Screening Report) but had the same purpose and content as an AIES screening report.

[1] https://infrastructure.planninginspectorate.gov.uk/projects/yorkshire-and-the-humber/a63-castle-street-improvement-hull/

1.1.4 The 2018 HRA Screening Report drew upon the relevant parts of the 2014 AIES of the preliminary design of the Scheme. The report was produced to assist Hull City Council (HCC) in its role as Competent Authority for the planning application and submitted to the MMO in support of an associated marine licence application for the Princes Quay Bridge works.

1.1.5 On the 12 April 2018, a precedent was set by a decision made by the Court of Justice of the European Union (CJEU) in the case of People Over Wind and Sweetman v Coillte Teoranta (C-323/17)[2]. The CJEU issued a judgement which ruled that Article 6(3) of the Habitats Directive must be interpreted as meaning that mitigation measures (referred to in the judgment as measures which are intended to avoid or reduce effects) should be assessed within the framework of AA. As such it is now not permissible to take account of measures intended to avoid or reduce the harmful effects of the plan or project on a European Site at the screening stage. As a consequence, the updated HRA Screening Report and this AIES screening report does not take into account mitigation measures, including aspects such as timing restrictions. A summary of the subsequent Sweetman v. An Bord Pleanála, Case C-258/11 CJEU judgment[3] confirms that:

"1. once you are in appropriate assessment territory, you can only take "measures" (i.e. mitigation) into consideration if you can guarantee beyond all reasonable doubt that the project will not adversely affect the integrity of the protected site (see para 52 of the judgement). The developer could not meet that test in this case because they were relying on mitigation being implemented in the future, the positive effects of which were inherently difficult to forecast with any certainty (this seems to preclude most forms of mitigation from being considered under art. 6(3)); and

2. if you fail to meet the test in 1 above, then any proposed mitigation should be treated as "compensatory measures" under art. 6(4) of the Directive and only once it is shown that:

a. the project must be carried out for imperative reasons of overriding public interest; and

b. there are no alternative solutions to the project being put forward."

1.1.6 The 2018 HRA Screening Report concluded that there were would be no significant effects to the Humber Estuary sites caused by the Princes Quay Bridge development. The majority of potential environmental effects that might be caused by the Scheme which is the subject of the DCO application relate to the construction of the Princes Quay Bridge and the support piling that will be required in the marina. However, this AIES screening report extends and refines the

[2] Court of Justice of the European Union (CJEU) People Over Wind and Sweetman v Coillte Teoranta (C-323/17). Available online at: http://curia.europa.eu/juris/document/document.jsf?docid=200970&doclang=EN

[3] Sweetman v. An Bord Pleanála, Case C-258/11, CJEU judgment 11 April 2013. Available online at: https://www.lexology.com/library/detail.aspx?g=5391bdbe-3e42-43e6-970b-33ce1d6fdea8

findings of the 2018 HRA Screening Report to the entire Scheme which is the subject of the DCO.

1.2 European protected sites

1.2.1 In accordance with HD44/09, the HRA screening process is required to take account of European Sites within 2km of proposed highway schemes, or within 30km if bats are one of the qualifying interests.

1.2.2 The Humber Estuary is the second largest coastal plain estuary in the UK, and the largest coastal plain estuary on the east coast of Britain. This area has three European designations: Special Area of Conservation (SAC), Special Protection Area (SPA) and Ramsar site. Together these designations form a European Marine Site (EMS). The Humber Estuary SAC extends to 36,657 hectares with the SPA covering 37,630 hectares and the Ramsar 37,988 hectares. The Humber Estuary is also designated as a Site of Special Scientific Interest (SSSI).

1.2.3 All designations share the same boundary close to the A63 with the proposed development taking place approximately 295m from the boundary of the Humber Estuary SAC, SPA and Ramsar sites. No other European Sites are located within 2km of the site boundary. There are no European Sites for which bats are one of the qualifying interests within 30km of the site.

1.2.4 More details regarding the European Sites and their characteristics can be found at Appendix A Characteristics of European Sites. The locations of European Sites in relation to the development were determined using the MAGIC website (www.magic.co.uk). This is shown at Appendix B.

2. Context

2.1 Scheme proposals

2.1.1 A detailed description of the Scheme is provided within the Environmental Statement (ES) for the A63 Castle Street Improvements, Volume 1 Chapter 2 The Scheme (document reference TR010016/APP/6.1). The Scheme proposals are illustrated on ES Volume 2 Figure 2.5 sheets 1 to 6 (document reference TR010016/APP/6.2) and summarised below.

2.1.2 Highways England is proposing to improve approximately 1.5km of the A63 Castle Street in Hull (hereafter referred to as 'the Scheme') in East Yorkshire between Ropery Street and the Market Place and Queen Street junctions. The route currently experiences congestion, particularly around Mytongate Junction.

2.1.3 The congestion is caused by restrictions to traffic flow at Mytongate Junction, three further signalised pedestrian crossings and from traffic turning and weaving to access side roads. Relieving the congestion would improve the currently poor journey times, and in turn improve access to the Port of Hull as well as access generally in the local area.

2.1.4 The signalised Mytongate Junction and other signalised pedestrian crossing facilities also have safety implications associated with pedestrians crossing the road at-grade. Pedestrians and vehicular travellers also experience safety issues from local traffic accessing side roads around Market Place, Humber Dock Street and Princes Dock Street and by weaving traffic entering and exiting the A63.

2.1.5 The works include lowering the level of the road into an underpass to create a grade separated junction, road widening, piling in the Humber Dock Marina to construct Princes Quay Bridge, the construction of Porter Street Bridge, relocation of the Spurn Lightship, drainage, service relocations, setting out of replacement land for public open space, works in Trinity Burial Ground and temporary use of a number of site compounds.

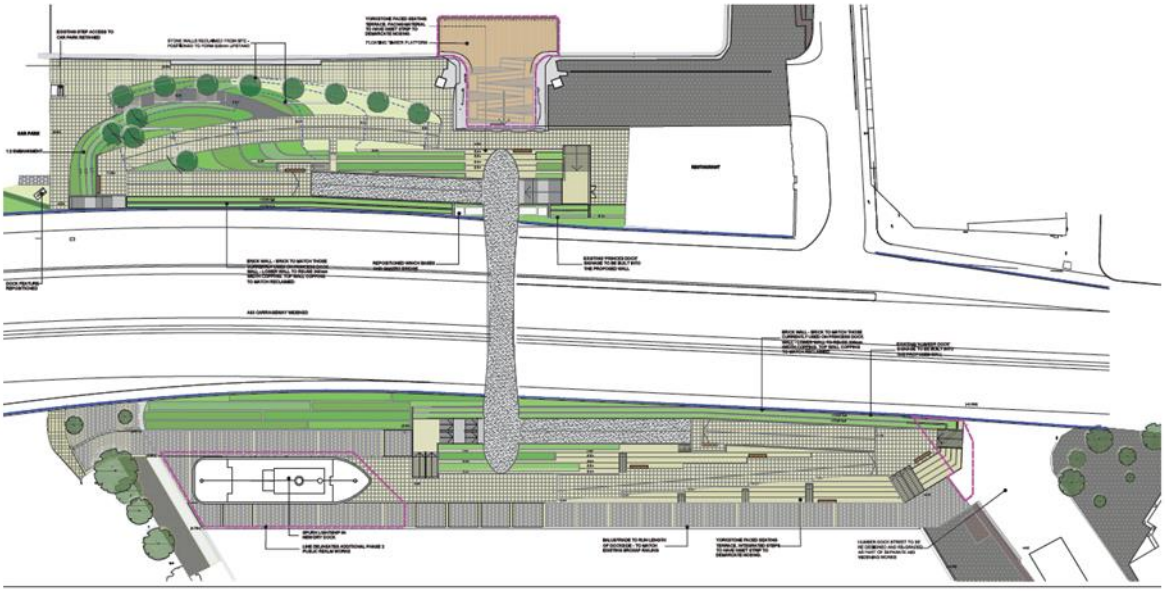
2.1.6 Eight potential sites have been identified as being suitable locations for construction compounds. These sites are listed below and shown on ES Volume 2 Figure 2.12 Construction site compound locations.

- Arco site (preferred Option A) or Staples site (alternative Option B) - bentonite compound
- Wellington Street Island Wharf (Spencers) - main site offices
- A63 Eastbound Recovery Base (A63 layby eastbound to the north of St Andrews Quay) - vehicle recovery
- Livingstone Road (South Humber Properties Ltd) - materials compound

- Land south east of Mytongate Junction - Trinity Burial Ground compound
- Neptune Street Set Down - Princes Quay Bridge compound, vehicle recovery and traffic management

2.1.7 The Scheme includes the construction of a new bridge crossing the A63, including the landscaped access ramps and stairs which are provided north and south of the A63. There would be a change of use to an area adjacent to Princes Dock Street to provide a new outdoor eating area for Ask Restaurant (current occupiers of Warehouse No. 6). There would also be a requirement for a site compound during construction. It is proposed that this is located at Neptune Street. A plan of the bridge is shown at Figure 2.1 below.

Figure 2.1 Plan View of Princes Quay Bridge



2.1.8 The proposed bridge will span over the A63 and a ramp at each side will provide access. Piling works are required at both sides of the bridge, for the foundations of the bridge, the ramps and the south marina platform. The north ramp and abutment are located in a landscaped area.

2.1.9 The south ramp and abutment are located in a landscaped area, sited on a berm of material that was previously reclaimed from the Humber Dock. The south marina platform extends from this berm out into Humber Dock Marina. The bridge is positioned over the location of the lock structure that used to connect Princes Dock with Humber Dock. The lock structure was infilled during the construction of the A63.

Hull Marina and Railway Dock

2.1.10 Immediately to the south of the development site for Princes Quay Bridge is the Hull Marina, the dimensions of which are approximately 278m length by 102m

width. Railway Dock lies to the west of the Humber Dock, approximately 60m from the development site. The dimensions of the Railway Dock are 211m length by 48m width. The depth of water in the marina is maintained at approximately 5m by pumps.

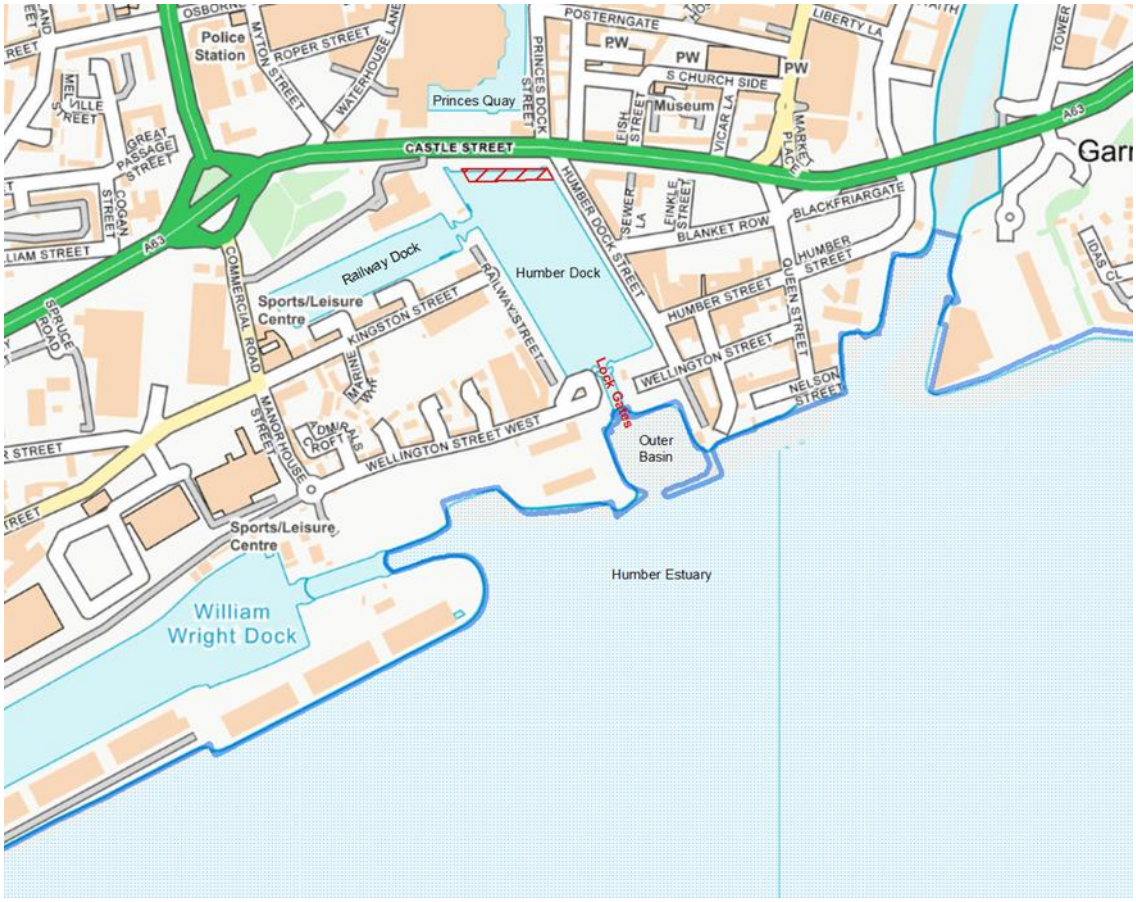
2.1.11 The Humber Dock is connected to the Humber Estuary via a pair of lock gates which open out into the Outer Humber Basin area. The Outer Humber Basin measures approximately 91m width by 90m length. There are no lock gates between Railway Dock and Humber Dock although there is a swing bridge for pedestrian traffic. The depth of water within the basin is unknown and dependent on tide levels.

2.1.12 The entire marina has berthing available for up to 220 vessels and these berths are currently 90% full. As a general rule the lock gates are operated for three hours either side of High Water. Within this timeframe, vessels enter and exit the marina as required. During busy periods in the summer, this can mean that the lock gates are constantly in use for a period of six hours with a typical full lock operation taking up to 15 minutes. The lock gates remain closed unless traffic wants to exit or enter the marina. As the vessels are the main leisure users, lock operations tend to be more frequent during school holidays and weekends. The most vessel movements occur during the sailing seasons with significantly fewer movements in the winter.

2.1.13 The lock gates operate conventionally with one set of gates closed at all times when vessels are leaving or entering the marina. The gates are only very rarely operated at low tide 'slack water' with both sets of gates being open simultaneously, where the movement of exceptionally long vessels is involved. If operations are required during 'slack water' then these are carried out under the supervision of lock engineers from HCC, within a maximum 30 minute window.

2.1.14 A general layout of the marina is shown at Figure 2.2 below.

Figure 2.2: Layout of the Railway Dock and Hull Marina (red hatch indicates area of proposed construction for Princes Quay Bridge; blue line indicates the boundary of the SAC/SPA/Ramsar)



OS_Open_Raster - Contains OS data © Crown Copyright and database right 2017

Piling works

2.1.15 Piling works are required at both sides of the bridge for the foundations of the bridge, the ramps and the south marina platform. The platform will extend the general landform on the south side of the main bridge into the existing Hull Marina creating a new marina edge. The platform will directly support the landscaped terracing with an integrated ramp and a marina edge walkway. These will be built using lightweight construction incorporating high density polystyrene blocks. The platform will also form the foundation for the upper ramp sections.

2.1.16 The platform is to be supported on piled foundations with a row of 17 concrete bored piles adjacent to the A63 carriageway as follows:

- 4 bored cast-in-place piles 1500mm diameter for the foundations of the bridge
- 3 bored cast-in-place piles 900mm diameter for the foundations of the north ramp
- The installation of ten bored cast-in-place piles of 900mm diameter

2.1.17 On the marina side there will be a row of 14 steel tubular driven piles 1016mm diameter and two 1168mm diameter driven steel bearing piles for the foundations of the south marina platform into Hull Marina. The works are to be undertaken from the shore and no there is to be no construction boat traffic.

2.1.18 The overwater piles will be steel tubes driven open ended through the alluvial deposits and glacial clays. It has been assumed that the piles will refuse in the fluvio-glacial sand and gravel. The piles will be pitched and driven from a crane sitting on land and a small platform will be in the water to allow the pile to be positioned and guided.

2.1.19 The platform is to be formed predominantly of precast concrete sections in order to simplify the construction over the water. The pile cap to the bored piles will be cast in-situ on the ground (in-situ ground beam). To minimise the thermal effects, the ground beam is to be made of three sections of continuous beams, rather than one single continuous beam.

2.1.20 The platform will comprise of bespoke precast pile crosshead beams spanning transversely between the in-situ ground beams and steel tubular piles. The precast slab units will be simply supported on the crosshead beams. An in-situ reinforced concrete topping slab will be placed on the top to provide a uniform smooth surface to receive waterproofing and to accommodate any differential movements between precast elements. The topping slab will have one layer of reinforcement mesh with saw cut joints or similar at regular spacings. Transverse spanning crosshead beams cantilever out over the piles to support the front and back edges of the new landscape terracing and walkways. On the southern edge simple precast rectangular elements stitched into the in-situ slab, will form a parapet beam carrying the marina edge balustrade.

Spurn Lightship

2.1.21 The construction of the bridge requires the relocation of the Spurn Lightship from its current moorings in the Hull Marina to alongside the south east quay wall of the marina. It would then be repositioned in the north west corner of the dock, to the west of its current location.

2.1.22 The last diving survey in April 2018 showed that the Lightship is floating. Relocation will require blanking up of the bulkheads and installing pumps to enable movement, prior to it being manually moved by ropes from the dockside to its temporary location. After construction, the ship will be moved to its permanent position in the same manner.

2.1.23 There is no fuel on board the Lightship. No external repairs are to be undertaken during the move. Subject to a funding bid, HCC may remove the Lightship from Hull Marina altogether during the works. It would be taken to a dry dock for repairs and ultimately to its final location in the north west of Hull Marina.

Neptune Street site compound

2.1.24 The proposed compound location for the bridge is a brown field site bounded by Neptune Street, Clive Sullivan Way and the Albert Dock, which leads to the Humber Estuary. The site is approximately 12,000m^2 and has minimum ground levels of 4.46m AOD which is above the Mean High Water Spring (MHWS) level of 3.7m AOD.

2.1.25 The site compound would be used for the purposes of a main compound for the day to day running of the construction of Princes Quay Bridge. It would house temporary staff accommodation including offices and welfare facilities. The site would be used for the delivery of most of the materials and storage and handling of materials. This would include drainage, earthworks, roadworks and structures supplies, precast concrete materials and plant and equipment for sub-contractors including traffic management equipment and barriers, with no loose material stored. The contractor has not yet been appointed so the frequency of deliveries has not been determined at this stage. The site would also be utilised for parking of key plant such as hiab, low loaders and traffic management vehicles. There would also be on site parking for staff vehicles.

2.1.26 After the construction of the bridge is complete, it is proposed that the site would be used as a set down compound for recovery vehicle drop-off and traffic management during the A63 Castle Street Improvements Scheme Construction Phase.

2.2 Statutory requirements for HRA

2.2.1 Under the European Community Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (EC 1992a) (the Habitats Directive)[2], all Member States are required to implement a network of protected sites and maintain their ecological integrity. This network of sites is collectively termed 'Natura 2000 Sites'. The aim of the Natura 2000 network of sites is to maintain long-term survival of Europe's most valuable and threatened species and habitats. An HRA screening exercise is therefore necessary to assess whether or not the Scheme will have any likely significant effects on European Sites (Natura 2000 sites, including Ramsar sites).

2.2.2 This screening process contains information to enable an assessment of likely significant effects arising from the development. This in turn informs the decision as to whether any further Appropriate Assessment (AA) is required. This is in compliance with Regulations 60 to 67 of the Conservation of Habitats and Species Regulations 2010, implementing Article 6(3) of the Habitats Directive (92/43/EEC on the Conservation of natural habitats and of wild fauna and flora[4]) and

[4] Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Available online at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31992L0043 (Accessed June 2018)

Regulations 61 to 69 of the Conservation of Habitats and Species Regulations 2017[5]. The core requirements of the Habitats Directive in respect of Natura 2000 Sites are given in Article 6 (3) as follows:

> "*Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public*."

2.2.3 This Screening Report has been prepared in accordance with the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 4, 'Assessment of Implications on European Sites' (HD44/09; Highways Agency, 2009), Interim Advice Note 141/11 'Assessment of Implications on European Sites' (Highways Agency, 2011), English Nature Habitats Regulations Guidance Notes 1-6 (English Nature, 1997) and the requirements of PINS Habitat Regulations Assessment (HRA) Relevant to Nationally Significant Infrastructure Projects, Advice Note 10; November 2017.

2.2.4 The Competent Authority for the A63 Castle Street Improvements Scheme is the Secretary of State for Transport.

2.3 Ecology baseline

2.3.1 Ecology surveys have been undertaken of the Scheme between 2013 and 2018. These are summarised in Appendix D.

2.4 Supporting data/evidence

Hydrology and water quality technical note

2.4.1 The purpose of the technical note was to review and evaluate the presence of any hydrological pathways between the Railway Dock and Hull Marina and the Humber Estuary. This would enable an understanding of the potential for sediment disturbance, construction related spills or pollution events to impact on the European protected sites designated at the Humber Estuary.

2.4.2 During construction of Princes Quay Bridge or any construction adjacent to or within the marina, there is a risk of sediment disturbance or contamination of the

[5] Conservation of Habitats and Species Regulations 2017. Available online at: http://www.legislation.gov.uk/uksi/2017/1012/pdfs/uksi_20171012_en.pdf

surface water within the docks either directly from construction / piling activities within the marina or due to a spillage of construction related materials such as oils, fuels, chemicals, concrete, bentonite slurry, cement or admixtures.

2.4.3 The ability of such an event to impact on the Humber Estuary European protected sites is dependent on the nature of the hydrological pathways between the construction site within Hull Marina and the Humber Estuary.

2.4.4 Consultation was carried out with BWML to ascertain the existing dimensions and operational characteristics of the Railway and Hull Marina and the lock gates which link the marina to the Humber Estuary. Using information obtained during consultation, it was possible to estimate typical volumes and rates of exchange of water between the marina and the Estuary.

2.4.5 The results of the above assessments concluded that the degree of dilution of any construction related sediment disturbance or pollution within the marina and the Humber Estuary would be sufficient to reduce the impact on the European Sites to a negligible level, particularly in the context of the scale and dynamism of the Estuary, and the paucity of relatively high value habitat within the vicinity of the site.

2.4.6 For more details see the Hydrology and water quality technical note at Appendix E.

Noise and vibration technical note

2.4.7 The purpose of the document is to provide a high-level technical review of the likely effect on birds of airborne noise and on seals and fish to underwater noise, in particular the wading birds on the mudflats, the lamprey and seals that populate the Humber Estuary Special Protection Area/Special Area of Conservation/Ramsar via Railway Dock and the Hull Marina. The purpose of the document is to evaluate the impact of piling activities to determine if this would have a significant effect on these species.

2.4.8 The assessment shows that wading birds are unlikely to be affected by piling noise and that lamprey may be affected by piling only if they stay trapped within the marina for a prolonged period as they are classified as species without-a-swim-bladder. Any seals trapped within the marina would be likely to suffer a temporary threshold shift (hearing injury). Potential impact on individuals or very low numbers would not have a significant effect on the favourable conservation status of grey seals as a qualifying feature. (Notwithstanding this, survey will be undertaken to minimise potential for any effect whatsoever prior to piling commencing, in line with good nature conservation practice). For more details see the Noise and vibration technical note at Appendix F.

MMO advice relating to grey seals

2.4.9 On 19 June 2018, consultation was undertaken by email with a Marine Conservation Officer from MMO. The purpose was to seek advice in relation to wildlife licensing in relation to noise impacts on grey seals within the Humber Estuary European Sites.

2.4.10 We were advised that "*While seals can be classified as features of European Marine Sites, and receive some protection by virtue of European legislation, they are not classified as European Protected Species (EPS) in wildlife legislation. Therefore, the relevant disturbance offences that apply to other marine EPS such as cetaceans, do not apply to seals. A wildlife licence under the Conservation of Habitats and Species Regulations 2017 is therefore not required for activities that may cause a disturbance to individual seals*.

2.4.11 *The only situations where disturbance of seals requires consideration is if they are the feature of a Special Area of Conservation (SAC) and there will be impact to their Favourable Conservation Status (FCS), or if they are listed as a feature of a SSSI. It is an offence to disturb any feature of a SSSI under the Wildlife and Countryside Act 1981*."

2.4.12 The implication of this advice is that the favourable conservation status of the population of grey seals as a qualifying feature of the SAC will not be significantly affected as only individual seals who have incidentally entered the docks before piling commences would be disturbed.

3. Assessment of likely significant effects

3.1 Introduction

3.1.1 The Humber Estuary SPA, SAC and Ramsar site are the only European designations in the vicinity of the proposals and are identified as the receptors that could be affected by the development.

3.1.2 In general, these important coastal sites typically comprise large, sheltered estuarine basins with extensive exposed mudflats and sandflats at low tide and / or discreet saline lagoons. Habitats are rich in invertebrates and plant life and of particular importance for supporting overwintering and migratory bird species and grey seals. Fish including the qualifying species of river and sea lamprey migrate in the water of the European Sites.

3.1.3 There will be no direct habitat loss at any of the European Sites, however the Screening Report considers the potential for the integrity of these European Sites, or their favourable status, to be affected by the A63 Castle Street Improvements Scheme, either alone or in combination with other plans or projects.

3.1.4 The assessment follows a step by step process based on the source-pathway-receptor model. Firstly, sources of impacts arising from the Scheme are identified that could affect the European Sites. Impact pathways are then examined to understand how these sources might affect the European Sites and undermine a Site's conservation objectives.

3.1.5 Finally, the assessment establishes whether the effect from each impact pathway on the European Site receptors is likely to be significant and concludes either No Significant Effect (NSE) or Likely Significant Effect (LSE).

3.2 Increased impermeable land - surface water run-off, deposition of dust, silt and sediments and pollution spills

Source

3.2.1 An increase in the volume of surface water run off may arise from the increased impermeable surfacing created by the development. Deposition and disturbance of dust, silt and sediments and other construction contaminants from the proposed development construction could enter into the Hull Marina, diffusing into the Humber Estuary.

3.2.2 There is also potential for pollutant spill incidents diffusing throughout the dock and into the designated sites arising from accidental spillage of chemicals and substances from construction compounds and activities (including equipment operating in the dock and the drilling mud plants). There is to be no construction traffic in the marina, so there will be no increase in boat traffic over the usual amount.

Pathways

3.2.3 Degradation caused by an increase in the volume of surface water run-off and changes in water quality could affect the habitats of the European Sites by reducing the amount of foraging resource (molluscs, crustaceans, amphibians and invertebrates) available to qualifying species of breeding, passage and migrant birds of the SPA and Criterion 6 of the Ramsar site and indirectly affecting their favourable conservation status.

3.2.4 Reduced dissolved oxygen levels arising from re-suspended sediments in the Humber Estuary could create a migration barrier to the SAC qualifying feature and Ramsar Criterion 8 qualifying species of lamprey.

3.2.5 Changes in favourable condition to intertidal mudflats and sandflats could affect the favourable conservation status of grey seals, a qualifying feature of the SAC and Ramsar Criterion 3 species.

Receptors

3.2.6 Receptors in the European Sites that increased surface water run-off and contamination from pollution spills could affect are provided at Appendix A and summarised below:

- All Annex I habitats that are a primary reason for designation of the SAC
- All Annex I habitats that are a qualifying feature of the SAC
- All Ramsar Criterion 1 habitats
- Qualifying species of breeding, passage and migrant birds of the SPA
- Ramsar Criterion 6 qualifying species of bird
- Ramsar Criterion 8 qualifying species of lamprey
- Ramsar Criterion 3 qualifying species of marine mammal

Impacts

3.2.7 Surface water from the Scheme would be discharged to the existing public sewer network at the existing flow rates. A network of on-site water collection attenuation features will retain any additional surface water/run-off.

3.2.8 The sediment disturbance arising from surface water run off and contamination from pollutants are unlikely to have a significant impact on the Humber Estuary protected sites due to the high degree of dilution within the marina and Estuary as demonstrated in the Hydrology and water quality technical note (Appendix E).

3.2.9 The rapid dispersal of nutrients and/or contaminants combined with dilution from tidal action will minimise the likelihood of algal blooms. Foraging resource

(molluscs, crustaceans, amphibians and invertebrates) available to qualifying species of breeding, passage and migrant birds of the SPA and Criterion 6 of the Ramsar site will not be affected and thus there are unlikely to be any indirect effects to their favourable conservation status.

3.2.10 Dissolved oxygen levels in the Humber Estuary will not be affected due to the high dilution of the sedimentation and as a result there will be NSE upon the favourable conservation status of migrating lamprey species.

3.2.11 The high dilution within the Humber Estuary will disperse the sedimentation and contamination thus intertidal mudflats and sandflats habitats will not be affected with NSE upon the favourable conservation status of grey seals.

3.3 Re-siting of the Spurn Lightship - sedimentation

Source

3.3.1 Sediment disturbance in the Hull Marina could be increased from movements during the relocation of the Spurn Lightship.

Pathways

3.3.2 Sediment disturbance has the potential to cause impacts to the water quality of the Humber Estuary via water passing through the marina and lock gates.

3.3.3 Degradation by sedimentation of the habitats could reduce the amount of foraging resource (molluscs, crustaceans, amphibians and invertebrates) available to qualifying species of breeding, passage and migrant birds of the SPA and Criterion 6 of the Ramsar site and indirectly affect their favourable conservation status.

3.3.4 The re-suspension of sediments has the potential to release nutrients and contaminants into the water column. High nutrient levels and lower light penetration can lead to algal blooms and a drop in levels of dissolved oxygen. Reduced dissolved oxygen levels in the Humber Estuary could create a migration barrier to the SAC qualifying feature and Ramsar Criterion 8 qualifying species of lamprey.

3.3.5 Changes in favourable condition to intertidal mudflats and sandflats could affect grey seals, a qualifying feature of the SAC and Ramsar Criterion 3 species.

Receptors

3.3.6 Receptors in the European Sites that could be affected by increased sedimentation are summarised below. Vulnerabilities of the European Sites are provided in Appendix A:

- All Annex I habitats that are a primary reason for designation of the SAC
- All Annex I habitats that are a qualifying feature of the SAC

- All Ramsar Criterion 1 habitats
- Qualifying species of breeding, passage and migrant birds of the SPA
- Ramsar Criterion 6 qualifying species of bird
- Ramsar Criterion 8 qualifying species of lamprey
- Ramsar Criterion 3 qualifying species of marine mammal

Impacts

3.3.7 The Lightship is to be moved across the dock manually by ropes. No other vessel is to be involved in the moving of the Lightship. The Lightship is currently floating, so disturbance to sediments will be minimal as the bed of the marina will not be disturbed.

3.3.8 Within the marina, it is likely that only individual lamprey and grey seals may enter accidentally due to the operation of the lock gates (Sections 2.1.10 – 2.1.14). In this unlikely event, disturbance would be at individual level and not affect the favourable population level status of these species across the designated sites.

3.3.9 The sediment disturbance would be minimal and is unlikely to have a significant impact on the Humber Estuary protected sites due to the high degree of dilution within the marina and Estuary as demonstrated in the Hydrology and water quality technical note (Appendix E). Due to the dynamic nature of the Humber Estuary, the rapid dispersal of nutrients combined with dilution from tidal action will minimise the likelihood of algal blooms within the designated sites. Foraging resource (molluscs, crustaceans, amphibians and invertebrates) available to qualifying species of breeding, passage and migrant birds of the SPA and Criterion 6 of the Ramsar site will not be affected and thus there are unlikely to be any indirect effects to their favourable conservation status.

3.3.10 Dissolved oxygen levels in the Humber Estuary will not be affected due to the high dilution of the sedimentation and as a result there will be NSE upon the habitat and favourable conservation status of migrating lamprey species.

3.3.11 The high dilution in the Humber Estuary will disperse any re-suspended sediments and thus intertidal mudflats and sandflats habitats will not be affected. It is concluded therefore that there will be NSE upon the habitat and favourable conservation status of grey seals.

3.4 Noise and vibration

3.4.1 Noise and vibration during construction and operation of the A63 Scheme has been assessed in the ES Volume 1 Chapter 7 Noise and Vibration (document reference TR010016/APP/6.1). The prediction of ground-borne vibration from construction activities such as piling and vibratory compaction indicates the potential for perceptible levels of vibration at receptors within 30m of the works.

3.4.2 The Humber Estuary designated sites are approximately 70m at the nearest point from the works on the Scheme to the River Hull harbour area where the designation ends and no effects from ground-borne vibration during construction are predicted. Impacts due to ground-borne vibration from road traffic during operation can be scoped out of the assessment as the surface of the carriageway would be renewed and be constructed to be free of discontinuities.

3.4.3 The Scheme does not contain habitats that support bird species which the Humber Estuary is designated for and the nearest habitats that could support qualifying bird species are at a distance where airborne construction noise would have no impacts. Operation noise will be airborne and would have no impacts upon the habitats, lamprey or grey seals of the Humber Estuary as noise and vibration from piling at Princes Quay Bridge (Appendix F) has been screened out which is a closer distance from the Humber Estuary than the operational road. This report therefore considers that there would be no significant effects to the Humber Estuary Sites.

3.5 Vibration from piling works in the marina for Princes Quay Bridge

Source

3.5.1 Vibration from piling works in the Hull Marina has the potential to cause disturbance of sediments in the marina.

Pathways

3.5.2 Sediment disturbance could cause impacts to the water quality of the Humber Estuary via water passing through the marina and lock gates.

3.5.3 Degradation by sedimentation of the habitats above could reduce the amount of foraging resource (molluscs, crustaceans, amphibians and invertebrates) available to qualifying species of breeding, passage and migrant birds of the SPA and Criterion 6 of the Ramsar site and indirectly affect their habitat and favourable conservation status.

3.5.4 The re-suspension of sediments has the potential to release nutrients into the water column. High nutrient levels and lower light penetration can lead to algal blooms and a drop in levels of dissolved oxygen. Reduced dissolved oxygen levels in the Humber Estuary could create a migration barrier to the SAC qualifying feature and Ramsar Criterion 8 qualifying species of lamprey.

3.5.5 Changes in favourable condition to intertidal mudflats and sandflats could affect grey seals, a qualifying feature of the SAC and Ramsar Criterion 3 species.

Receptors

3.5.6 Receptors in the European Sites that could be affected by increased sedimentation are summarised below and vulnerabilities of the European Sites are provided in Appendix A:

- All Annex I habitats that are a primary reason for designation of the SAC
- All Annex I habitats that are a qualifying feature of the SAC
- All Ramsar Criterion 1 habitats
- Qualifying species of breeding, passage and migrant birds of the SPA
- Ramsar Criterion 6 qualifying species of bird
- Ramsar Criterion 8 qualifying species of lamprey
- Ramsar Criterion 3 qualifying species of marine mammal

Impacts

3.5.7 It is unlikely that lamprey or grey seals would enter the marina at all. If one of these species were to enter the marina through the lock gates then it is likely only to be an individual. Therefore, disturbance would be at individual level and this would not affect the favourable population level status of these species across the designated sites.

3.5.8 The sediment disturbance is unlikely to have a significant impact on the Humber Estuary protected sites due to the high degree of dilution within the marina and Estuary as demonstrated in the Hydrology and water quality technical note (Appendix E). Due to the dynamic nature of the Humber Estuary, the rapid dispersal of nutrients combined with dilution from tidal action will minimise the likelihood of algal blooms. Foraging resource (molluscs, crustaceans, amphibians and invertebrates) available to qualifying species of breeding, passage and migrant birds of the SPA and Criterion 6 of the Ramsar site will not be affected and thus there are unlikely to be any indirect significant effects to their habitat and favourable conservation status.

3.5.9 Dissolved oxygen levels in the Humber Estuary will not be affected due to the high dilution of the sedimentation. As a result, there will be NSE upon the habitat and favourable conservation status of migrating lamprey species.

3.5.10 The high dilution will disperse any re-suspended sediments and thus intertidal mudflats and sandflats habitats will not be affected. There will be NSE to the habitat and favourable conservation status of grey seals.

3.6 Noise and vibration from piling in the marina for Princes Quay Bridge – aquatic fauna

Source

3.6.1 Piling in the Hull Marina has the potential to cause airborne noise and underwater noise and vibration within the aquatic environment and within the marine substrate, potentially diffusing in the European Sites.

Pathways

3.6.2 Potential impacts arising from airborne noise and underwater noise and vibration include injuries (including hearing impairment) and behavioural changes (including changes in feeding areas) to qualifying species of breeding, passage and migrant birds of the SPA and Criterion 6 of the Ramsar site. This may indirectly affect their favourable conservation status.

3.6.3 Possible impacts during the construction phase include disturbance or injury to lamprey (SAC qualifying feature and Ramsar Criterion 8 qualifying species).

3.6.4 Potential impacts include injuries (including hearing impairment) and behavioural changes (including changes in feeding areas) to marine grey seals, a qualifying feature of the SAC and Ramsar Criterion 3 species.

Receptors

3.6.5 Receptors in the European Sites that could be affected by airborne noise and underwater noise and vibration are summarised below. More details regarding vulnerabilities of the European Sites are provided in Appendix A:

- Qualifying species of breeding, passage and migrant birds of the SPA
- Ramsar Criterion 6 qualifying species of bird
- Ramsar Criterion 8 qualifying species of lamprey
- Ramsar Criterion 3 qualifying species of marine mammal

Impacts

Airborne noise, underwater noise and vibration - birds

3.6.6 The closest qualifying bird species recorded during the 2017 surveys were on mudflats to the north east on the River Hull approximately 600m from the works. In respect of birds, the potential impacts from airborne noise constitute disturbance of foraging, in particular populations of redshank on these mudflats (Appendix D). The Noise and Vibration Technical Note (Appendix F) predicted the ambient traffic noise combined with the piling noise would only increase noise levels by 1dB to 5dB. While piling noise is likely to be audible to the birds above the sound of the highway, the combined noise level will increase by only 1dB to 5dB and they are unlikely to be affected by the noise. The nearest mudflats within the designated sites but where SPA/Ramsar qualifying birds were not recorded by MMSJV are approximately 310m away in the Outer Humber Basin at the other side of the dock gates. The majority of this small area of mudflat is enclosed by the urban environment, is normally subject to disturbance from vessels and as such is less suitable to support SPA/Ramsar qualifying birds. Although no birds were recorded during the surveys, it is possible that SPA/Ramsar qualifying birds may use the Outer Humber Basin but not in significant numbers of their species' populations.

The ambient traffic noise from the A63 in the Outer Humber Basin is comparable to the noise that piling is expected to produce. While piling noise is likely to be audible to the birds, they are unlikely to be affected by the noise. As birds in the Outer Humber basin are likely to be in low numbers if present, in the unlikely event of disturbance from airborne noise, underwater noise and vibration, this would be at individual level and not affect the favourable population level status of these species'. The 2017 bird survey results indicate that there will be no potential impact upon the favourable conservation status of passage species of international importance as none were recorded.

3.6.7 Direct impacts to birds from underwater noise and vibration are considered to be negligible due to the distance from site of the mudflats (nearest mudflats are approximately 310m away). Airborne and underwater noise and vibration disturbance is unlikely to indirectly affect prey species of qualifying bird species and their favourable conservation status due to the significant dilution of re-suspended sediments in the Humber Estuary. Taking this into account, the assessment concludes that there would be NSE to the Humber Estuary European site bird species arising from airborne noise, underwater noise and vibration.

Airborne noise, underwater noise vibration - lamprey

3.6.8 Noise and vibration arising from the piling operations could result in impacts to fish species including lamprey. However, there is no evidence that lampreys are present within the Humber Dock area, although there is the potential for them to enter the Hull Marina via the lock gates.

3.6.9 Piling within the marina could cause a temporary barrier slowing migration as the lamprey may be deterred from passing during piling, leading to impacts upon migratory species for the duration of construction. However, the docks within and adjacent to the site are not directly on a migratory path and unlikely to support spawning river or sea lamprey as the waters are saltwater and lamprey spawn in freshwater further upstream of the docks.

3.6.10 Lamprey are less sensitive to barotrauma (due to the lack of a gas bladder) although they rely on particle motion to detect sound. The Noise and vibration technical note (Appendix F) shows that lamprey may be affected by piling only if they stay within 25m of piling activity for a prolonged period as they are classified as species without a swim bladder. This could create a risk of a behavioural change and Temporary Threshold Shift (TTS), with some risk of recoverable injury and a low risk of mortality or mortal injury. All of these risks would increase for lamprey that are closer to the seat of piling and diminish at greater distances.

3.6.11 With one set of lock gates closed virtually all of the time, sound is not predicted to propagate above the levels causing barriers to fish over the whole width of the Humber Estuary. In addition, fish are able to swim around the areas with high sound levels. Following cessation of piling works, fish including lamprey will be expected to re-enter the areas previously affected by the highest noise and vibration levels.

3.6.12 Within the marina, it is likely that only individual lamprey may enter incidentally due to the operation of the lock gates. In this unlikely event, disturbance or injury would be at individual level and not affect the favourable population level status of this species.

3.6.13 Taking into account their low sensitivity to noise and vibration, and the likely infrequent populations of lamprey within the Hull Marina, it is anticipated that there would be negligible impacts on migratory fish species of international importance. It is therefore concluded that there is likely to be NSE to the Humber Estuary European sites arising from impacts from noise and vibration to fish species.

Airborne noise, underwater noise and vibration - seals

3.6.14 Grey seals use the Humber Estuary for foraging and haul-out and have a breeding population at Donna Nook, approximately 40km from the piling works. There is potential for impacts from airborne noise which could constitute disturbance of foraging, however this is likely to be minimal given the distance of their colony, and favoured haul out areas from the development, with sightings in the middle estuary predominantly being limited to individuals or pairs only.

3.6.15 Direct impacts to seals in the Humber Estuary from airborne noise, underwater noise and vibration are considered to be negligible as seals are able to swim away from sources of disturbance. Noise and vibration disturbance is unlikely to indirectly affect prey species of grey seal. For more details refer to the Noise and vibration technical note at Appendix F.

3.6.16 Within the marina, it is likely that only individual grey seals may enter incidentally, due to the operation of the lock gates. In this unlikely event, disturbance from airborne noise, underwater noise and vibration would be at individual level and not affect the favourable population level status of these species.

3.6.17 It is therefore concluded that there will be NSE to the favourable population of grey seals arising from impacts from noise and vibration as a result of the development.

3.7 Air emissions

3.7.1 The Scheme is located in the Hull Air Quality Management Area (AQMA), and the current baseline NO_2 concentrations exceed the annual mean NO_2 objective at roadside locations adjacent to the Scheme.

3.7.2 A qualitative assessment of potential dust effects during construction has been undertaken following a review of likely dust raising activities and identification of sensitive receptors within 200m of these activities. See ES Volume 1 Chapter 6 Air quality, document reference TR010016/APP/6.1 for more details.

3.7.3 Construction traffic and traffic management measures have been quantitatively assessed using atmospheric dispersion modelling to determine the potential local

air quality impacts during the Construction and Operation Phases from vehicle emissions.

3.7.4 Road traffic can contribute substantially to the atmospheric pollution load through emission of pollutants including carbon dioxide (CO_2), oxides of nitrogen (NO_x), dust, sulphur dioxide (SO_2) and ozone (O_3). For the assessment of air quality impacts on the Humber Estuary, only changes in levels of oxides of nitrogen (NO_x) were modelled, for the following reasons:

- Despite the general association with nitrogen dioxide, ozone levels are not as high in urban areas (where high levels of nitrogen dioxide are emitted) as in rural areas. This is largely due to the long-range nature of this pollutant, which is sufficiently great that the source of emission and location of deposition often cross-national boundaries. As such, low-level ozone can only be practically addressed at the national and international level.

- The main potential source of SO_2 is the potential for new or expanded industrial development to use oil or coal as a source of heat and power (i.e. not road traffic related).

- Although carbon dioxide is an important greenhouse gas, it is not possible to relate quantities of CO_2 to specific effects on specific European sites. It is therefore not possible to consider these within the scope of this AIES other than by noting that increased emission of CO_2 will contribute at a global scale to accelerating rates of climate change.

- Emissions of heavy metals from diesel fuel cannot be adequately attributed to changes in traffic or transport levels and growth, as the distribution of fuels used cannot be analysed or predicted in sufficient detail.

- Elevated NO_x concentrations can adversely affect ecosystems.

3.7.5 Calculation of the annual mean NOx concentrations at the European Sites with and without the Scheme was undertaken. Where NOx concentrations exceeded the annual objective, and Scheme associated changes in NOx were greater than 0.4µg/m3, then nutrient nitrogen deposition was also calculated and used to determine the overall significance of the Scheme impact.

3.7.6 NOx concentrations for the three receptor transects in the Humber Estuary designated sites were modelled. The Grid References where the 200m transects commence on the bank of the River Humber are at: 505699, 426427 (Transect 1); 504465, 425989 (Transect 2) and 503418, 425800 (Transect 3) and extend southwards across the river. The ecological receptors were modelled at a height of 0m. The transect locations are shown at ES Volume 2 Air Quality Figure 6.6 Operation Phase: Modelled receptor locations (ecological). This document is also appended to this report at Appendix G for information.

3.7.7 In the Opening Year of the Scheme, the annual mean NOx objective (30g/m3) is predicted to be exceeded at the edge of the designated sites. For Transect 1, only the first modelled point is predicted to exceed the objective as this is the closest point to the A63; concentrations are predicted to decrease to below the objective over the next 10m increment. Modelled NOx concentrations are predicted to be below the annual mean objective at all receptors in Transect 2 and Transect 3 as they are further from the A63 main carriageway than Transect 1.

3.7.8 The Scheme is predicted to lead to increases in NOx in the designated site (along all three transects), due to a predicted increase in traffic of between 1,000 to 2,000 vehicles per day on the adjacent section of the A63. However, only the first modelled point of Transect 1 has a predicted change greater than 0.4g/m3 and total concentrations above 30µg/m3. Nitrogen deposition at this location has been assessed using APIS[6] deposition rates and critical loads for the habitat classification of coastal saltmarsh. It should be noted that United Nations Economic Commission for Europe (UNECE) estimates a critical load for coastal salt marsh of 30-40 kg(N)/ha/yr, as reported in DMRB guidance. The APIS critical load is lower than this (20–30 kg(N)/ha/yr) and has been applied as a worst-case approach resulting in no significant effects.

Table 2.1: APIS Total nitrogen deposition

Transect	APIS habitat classification	Total background nitrogen deposition Base Year[1]	Total background nitrogen deposition Scheme Opening Year[1]	APIS critical load range
		(kg (N) / ha / yr)	(kg (N) / ha / yr)	(kg (N) / ha / yr)
Transect 1	Coastal Saltmarsh	16.9	13.8	20-30

Notes: (1) Based on a 2% reduction in deposition per year from 2014 (APIS deposition is 17.2 kg (N) / ha / yr in 2014)

3.7.9 Based on the detailed dispersion modelling carried out, concentrations of NO_2 have been determined at the first receptor in Transect 1. DMRB guidance requires that dry NO_2 deposition, which is a component of total nitrogen deposition, is calculated from the NO_2 concentration predicted. The road contribution to dry NO_2 deposition has been determined by subtracting the dry NO_2 deposition rate for the APIS square from the receptor dry NO_2 deposition rate. This provides the road contribution to dry NO_2 deposition and is presented in Table 4.2 for the Base, Do Minimum and Do Something Scenario.

Table 2.2: Modelled road contribution to NO_2 dry deposition

Transect	Distance to	Modelled road contribution to NO_2 dry deposition (kg (N) ha / yr)

[6] Air Pollution Information System (APIS) Available online at www.apis.ac.uk,

	'affected' road (m)	2015 Base	2025 DM	2025 DS	Change
Transect 1	3 (a)	2.11	1.68	1.72	0.04 (0.13-0.2% of critical load)

Note: (a) indicates the closest point to the affected road
DM = Do Minimum (without Scheme); DS = Do Something (with Scheme)
Results presented have been rounded to 2dp to indicate direction of change and is not a reflection of model accuracy.

3.7.10 The modelled road contribution to NO_2 dry deposition has been added to the APIS average total background nitrogen deposition rates shown in Table 2.1 to give the total nitrogen deposition rate at the receptor, as presented in Table 2.3.

3.7.11 Total nitrogen deposition is below the critical load range in all scenarios, and the change in deposition associated with the Scheme is less than 1% of the critical load. These air quality effects and the Scheme impacts are concluded to be not significant for ecological receptors based on the magnitude of increase and because the flushing action due to tides is likely to reduce the input of atmospheric nitrogen (N) to the saltmarsh ecosystem.

Table 2.3: Modelled total nitrogen deposition

Transect	APIS Habitat Classification	Distance to 'affected' road (m)	Total N deposition (kg (N) ha / yr)			APIS critical load range
			2015 Base	2025 DM	2025 DS	(kg (N) / ha / yr)
Transect 1	Coastal Saltmarsh	3 (a)	18.99	15.46	15.51	20-30

Note: (a) indicates the closest point to the affected road
DM = Do-Minimum (without Scheme); DS = Do-Something (with Scheme)
Results presented have been rounded to 2dp to indicate direction of change and is not a reflection of model accuracy.

3.7.12 It can be concluded that there will be no impacts and therefore no significant effects from air emissions on the European Sites and as such no impacts or significant effects upon the species that the Sites are designated for.

3.8 Groundwater contamination

3.8.1 The Scheme will have a limited localised impact on groundwater levels and flows in the superficial deposits during construction, which may cause some local migration of existing contaminants. However, the degree of hydraulic connectivity between groundwater at the development site and the Humber Estuary is likely to be very limited and the zone of influence for the underpass construction is small and does not extend to the estuary. Therefore, the impacts on conveyance of flow to the Humber Estuary, and resultant impacts on water quality due to pollution as a

result of spillages, direct contact with construction materials and mobilisation of contamination due to ground disturbance are all considered to be negligible.

3.8.2 There appears to be a hydraulic connection between the Scheme and estuary within the underlying chalk bedrock. Although locally, the hydraulic gradient is either to the north during high tide or southwards during low tide, the regional hydraulic gradient is towards the south and the estuary. However, changes to groundwater flow, quality or levels would be negligible as the zone of influence of the Scheme does not extend as far as the Estuary. This is because of the very limited hydraulic connection between the docks and the Humber Estuary and superficial deposits aquifer units. Installation of diaphragm walls and tension piles during construction would have a minor impact on water quality in the chalk but this is very unlikely to adversely affect the Humber Estuary leading to a conclusion of no significant effects.

3.9 Site compounds

3.9.1 It has been established that all of the site compounds proposed for the Scheme are above the Mean High Water Spring (MHWS) level of 3.7m AOD. The location of the compounds is shown in ES Volume 2 Figure 2.12 (document reference TR010016/APP/6.2). It is considered that works in the compounds would have no significant effects to the Humber Estuary sites.

3.10 Summary of effects

3.10.1 Taking into account the above, it is therefore concluded that there are No Significant Effects (NSE) to the Humber Estuary or any other European Sites arising from the Scheme.

3.11 Cumulative impacts

3.11.1 Cumulative impacts from the proposed advanced works at Princes Quay Bridge and the main A63 Castle Street Improvements Scheme have been assessed in this report and in combination there would be NSE.

3.12 PINS Advice Note 10 Appendix 1 Screening Matrices

3.12.1 As explained in the PINS Advice Note 10 Habitats Regulations Assessment November 2017 Version 8, a set of matrices has been developed to assist the Secretary of State, as the Competent Authority in fulfilling the requirements of the Habitats Directive and the Habitats Regulations in the context of the 2008 Act process. The matrices are intended to clearly present the outcomes at each stage of the process in a standardised tabular form for the benefit of all those involved in the application and examination. The matrices in Appendix C of this report contain the combined outcomes of the process for both the main improvement works on the A63 and Princes Quay Bridge.

3.12.2 The matrices comprise:

- Screening Matrices (HRA Stage 1: Screening) - which summarise the screening exercise for Likely Significant Effects of the Scheme on the European Sites and qualifying features considered.

- Integrity Matrices (HRA Stage 2: Appropriate Assessment) - which summarise the potential adverse effects on integrity of the European Sites, where Likely Significant Effects have been identified.

4. Conclusion

4.1.1 In conclusion, the HRA Screening process has demonstrated that there is sufficient information and assessment evidence to fully assess likely impacts on the integrity or favourable conservation status of the Humber Estuary SPA, SAC and Ramsar site arising from the A63 Castle Street Improvements.

4.1.2 The AIES Report for the A63 Castle Street Improvements assessment has considered impacts resulting from construction works and impact pathways arising from sediment disturbance, surface water discharge, pollution incidents such as deposition of dust and other contaminants, air quality, groundwater and from noise and vibration. In all cases, the assessment has concluded that there are no likely significant effects.

4.1.3 The report also concludes that works in the compounds would have no significant effects to the Humber Estuary sites as they are all located above MHWS.

4.1.4 In terms of cumulative impact, as there are no impacts from this Scheme, other projects or plans could not add cumulative impacts or affect the outcome of this screening assessment.

4.1.5 In conclusion, the AIES Screening Report for the A63 Castle Street Improvements Scheme concludes that without mitigation, the proposed development will cause **No Significant Effects** to the European Sites located within 2km of the Scheme either alone or in-combination with other projects and plans. There are no European Sites for which bats are one of the qualifying interests within 30km of the site. Therefore, no further stages of HRA are considered necessary.

Appendices

Appendix A: Characteristics of European Sites

Name of European Site and EU code	Qualifying features	Vulnerabilities	Conservation objectives
Humber Estuary SAC UK0030170	**Annex I habitats that are a primary reason for selection of this site:** **Estuaries** It is a muddy, macro-tidal estuary, fed by the Rivers Ouse, Trent and Hull, Ancholme and Graveney. Suspended sediment concentrations are high, and are derived from a variety of sources, including marine sediments and eroding boulder clay along the Holderness coast. Habitats within the estuary include: • Atlantic salt meadows • Sandbanks which are slightly covered by seawater all the time • Mudflats and sandflats not covered by seawater at low tide • *Salicornia* and other annuals colonising mud and sand • Coastal lagoons **Mudflats and sandflats not covered by seawater at low tide** Upstream from the Humber Bridge, extensive mud and sand bars in places form semi-permanent islands.	The Humber Estuary is subject to the impacts of human activities (past and present) as well as ongoing processes such as sea level rise and climate change. Management intervention is therefore necessary to enable the estuary to recover and to secure the ecological resilience required to respond to both natural and anthropogenic change. Key issues include coastal squeeze, impacts on the sediment budget, and geomorphological structure and function of the estuary (due to sea level rise, flood defence works, dredging, and the construction, operation and maintenance of ports, pipelines and other infrastructure), changes in water quality and flows, pressure from additional built development, and damage and disturbance arising from access, recreation and other activities. Coastal squeeze is being addressed through the development and implementation of the Humber Flood	Fish species migrating into or through the estuary: subject to natural change, maintain in favourable condition the habitat and migratory route (for River Lamprey and Sea Lamprey). Marine mammals feeding, resting and breeding in the estuary: subject to natural change, maintain in favourable condition the intertidal mudflats and sandflats (for grey seal). Estuarine habitats above high water: subject to natural change, maintain in favourable condition the coastal lagoons, annual vegetation of drift lines, embryonic shifting dunes, shifting dunes along the shoreline with Marram grass, fixed dunes with herbaceous

Name of European Site and EU code	Qualifying features	Vulnerabilities	Conservation objectives
	Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site: • Sandbanks which are slightly covered by sea water all the time • Coastal lagoons * Priority feature • *Salicornia* and other annuals colonizing mud and sand • Atlantic salt meadows (Glauco-Puccinellietalia maritimae) • Embryonic shifting dunes • Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes") • Fixed coastal dunes with herbaceous vegetation ("grey dunes")* Priority feature • Dunes with *Hippophae rhamnoides* **Annex II species that are a primary reason for selection of this site:** Not applicable. **Annex II species present as a qualifying feature, but not a primary reason for site selection:** • Sea lamprey *Petromyzon marinus* • River lamprey *Lampetra fluviatilis* • Grey seal *Halichoerus grypus*	Risk Management Strategy. All proposals for flood defence, development, dredging, abstractions and discharges which require consent from any statutory body, and land use plans which may have impacts upon the site are subject to assessment under the Conservation (Natural Habitats, &c.) Regulations 2010 (the "Habitats Regulations"). Diffuse pollution will be addressed through a range of measures including implementation of the Waste Water Framework Directive and Catchment Sensitive Farming initiatives. Other issues are addressed via a range of measures including regulation of on-site land management activities and implementation of the Humber Management Scheme, developed by all relevant statutory bodies to assist in the delivery of their duties under the Habitats Regulations.	vegetation and dunes with Sea Buckthorn. Estuarine habitats between high water and low water: subject to natural change, maintain in favourable condition the estuary, mudflats and sandflats not covered by seawater at low tide, saltmarshes, Salicornia and other annuals colonising mud and sand; Spartina swards and Atlantic salt meadows. Estuarine habitats below low water: subject to natural change, maintain in favourable condition the estuarine waters and sandbanks which are slightly covered by sea water all the time.

Name of European Site and EU code	Qualifying features	Vulnerabilities	Conservation objectives
Humber Estuary SPA UK9006111	**ARTICLE 4.1 QUALIFICATION (79/409/EEC):** During the breeding season the area regularly supports: • Bittern. *Botaurus stellaris* (Europe - breeding) 10.5% of the population in Great Britain 2000-2002 • Marsh Harrier. *Circus aeruginosus* 6.3% of the population in Great Britain 1998-2002 • Avocet. *Recurvirostra avosetta* (Western Europe/Western Mediterranean - breeding) 8.6% of the population in Great Britain 1998-2002 • Little tern. *Sterna albifrons* (Eastern Atlantic - breeding) 2.1% of the population in Great Britain 1998-2002 Over winter the area regularly supports: • Bittern. *Botaurus stellaris* (Europe - breeding) 4% of the population in Great Britain 1998/9 to 2002/3 • Hen Harrier, *Circus cyaneus* 1.1% of the population in Great Britain 1997/8 to 2001/2 • Bar- tailed godwit, *Limosa lapponica* (Western Palearctic - wintering) 4.4% of the population in Great Britain 1996/7 to 2000/1 • Golden plover, *Pluvialis apricaria* (North-western Europe - breeding) 12.3% of the population in Great Britain 1996/7 to 2000/1	The Humber Estuary is subject to the impacts of human activities (past and present) as well as ongoing processes such as sea level rise and climate change. Management intervention is therefore necessary to enable the estuary to recover and to secure the ecological resilience required to respond to both natural and anthropogenic change. Key issues include coastal squeeze, impacts on the sediment budget, and geomorphological structure and function of the estuary (due to sea level rise, flood defence works, dredging, and the construction, operation and maintenance of ports, pipelines and other infrastructure), changes in water quality and flows, pressure from additional built development, and damage and disturbance arising from access, recreation and other activities. Coastal squeeze is being addressed through the development and implementation of the Humber Flood	Avoid the deterioration of the habitats of the qualifying features, and the significant disturbance of the qualifying features, ensuring the integrity of the site is maintained and the site makes a full contribution to achieving the aims of the Birds Directive. Subject to natural change, to maintain or restore: • The extent and distribution of the habitats of the qualifying features; • The structure and function of the habitats of the qualifying features; • The supporting processes on which the habitats of the qualifying features rely; • The populations of the qualifying features;

Name of European Site and EU code	Qualifying features	Vulnerabilities	Conservation objectives
	• Avocet, *Recurvirostra avosetta* (Western Europe/Western Mediterranean - breeding) 1.7% of the population in Great Britain 1996/7 to 2000/1 On passage the area regularly supports: • Ruff, *Philomachus pugnax* (Western Africa - wintering) 1.4% of the population in Great Britain 1996-2000 **ARTICLE 4.2 QUALIFICATION (79/409/EEC):** Over winter the area regularly supports: • Dunlin, *Calidris alpina alpina* (Northern Siberia/Europe/Western Africa) 1.7% of the population 1996/7 to 2000/1 • Knot, *Calidris canutus* (North-eastern Canada/Greenland/Iceland/North-western Europe) 6.3% of the population 1996/7 to 2000/1 • Black tailed godwit, *Limosa limosa islandica* (Iceland - breeding) 3.2% of the population 1996/7 to 2000/1 • Common shelduck,*Tadorna tadorna* (North-western Europe) 1.5% of the population 1996/7 to 2000/1 • Redshank, *Tringa totanus* (Eastern Atlantic - wintering) 3.6% of the population 1996/7 to 2000/1 On passage the area regularly supports:	Risk Management Strategy. All proposals for flood defence, development, dredging, abstractions and discharges which require consent from any statutory body, and land use plans which may have impacts upon the site are subject to assessment under the Conservation (Natural Habitats, &c.) Regulations 1994 (the "Habitats Regulations"). Diffuse pollution will be addressed through a range of measures including implementation of the Waste Water Framework Directive and Catchment Sensitive Farming initiatives. Other issues are addressed via a range of measures including regulation of on-site land management activities and implementation of the Humber Management Scheme, developed by all relevant statutory bodies to assist in the delivery of their duties under the Habitats Regulations.	• The distribution of the qualifying features within the site. Qualifying Features: A021 *Botaurus stellaris*; Great bittern (Non-breeding) A021 *Botaurus stellaris*; Great bittern (Breeding) A048 *Tadorna tadorna*; Common shelduck (Non-breeding) A081 *Circus aeruginosus*; Eurasian marsh harrier (Breeding) A082 *Circus cyaneus*; Hen harrier (Non-breeding) A132 *Recurvirostra avosetta*; Pied avocet (Non-breeding) A132 *Recurvirostra avosetta*; Pied avocet (Breeding)

Name of European Site and EU code	Qualifying features	Vulnerabilities	Conservation objectives
	• Dunlin, *Calidris alpina alpina* (Northern Siberia /Europe/Western Africa) 1.5% of the population 1996-2000 • Knot, *Calidris canutus* (North-eastern Canada / Greenland / Iceland / North-western Europe) 4.1% of the population 1996-2000 • Black-tailed godwit, *Limosa limosa islandica* (Iceland - breeding) 2.6% of the population 1996-2000 • Redshank, *Tringa totanus* (Eastern Atlantic - wintering) 5.7% of the population 1996-2000 **ARTICLE 4.2 QUALIFICATION (79/409/EEC): AN INTERNATIONALLY IMPORTANT ASSEMBLAGE OF BIRDS** Over winter the area regularly supports: 153934 waterfowl (5 year peak mean 1996/7 to 2000/1) Including: *Anas crecca , Anas penelope , Anas platyrhynchos , Arenaria interpres , Aythya ferina , Aythya marila , Botaurus stellaris , Branta bernicla bernicla , Bucephala clangula , Calidris alba , Calidris alpina alpina , Calidris canutus , Charadrius hiaticula , Haematopus ostralegus , Limosa lapponica , Limosa limosa islandica , Numenius*		A140 *Pluvialis apricaria*; European golden plover (Non-breeding) A143 *Calidris canutus*; Red knot (Non-breeding) A149 *Calidris alpina alpina*; Dunlin (Non-breeding) A151 *Philomachus pugnax*; Ruff (Non-breeding) A156 *Limosa limosa islandica*; Black-tailed godwit (Non-breeding) A157 *Limosa lapponica*; Bar-tailed godwit (Non-breeding) A162 *Tringa totanus*; Common redshank (Non-breeding) A195 *Sterna albifrons*; Little tern (Breeding) Waterbird assemblage

Name of European Site and EU code	Qualifying features	Vulnerabilities	Conservation objectives
	arquata , Numenius phaeopus , Philomachus pugnax , Pluvialis apricaria , *Pluvialis squatarola , Recurvirostra avosetta , Tadorna tadorna , Tringa nebularia , Tringa totanus , Vanellus vanellus*		
Humber Estuary Ramsar site UK11031	**Ramsar criterion 1** The site is a representative example of a near-natural estuary with the following component habitats: • dune systems and humid dune slacks, estuarine waters, intertidal mud and sand flats, saltmarshes, and • coastal brackish/saline lagoons. It is a large macro-tidal coastal plain estuary with high suspended sediment loads, which feed a dynamic and rapidly changing system of accreting and eroding intertidal and subtidal mudflats, sandflats, saltmarsh and reedbeds. Examples of both strandline, foredune, mobile, semi-fixed dunes, fixed dunes and dune grassland occur on both banks of the estuary and along the coast. The estuary supports a full range of saline conditions from the open coast to the limit of saline intrusion on the tidal rivers of the Ouse and Trent. Wave exposed sandy shores are found in the outer/open coast areas of the estuary. These change to the more moderately exposed sandy shores and then to sheltered muddy shores within the main body of the	**Those factors that are still operating, but it is unclear if they are under control, as there is a lag in showing the management or regulatory regime to be successful.** • Pollution – domestic sewage. Reduced dissolved oxygen in River Ouse is a barrier to fish migration. Review of consents well advanced but not yet implemented. Major factor. • Pollution – agricultural fertilisers. Reduced dissolved oxygen in River Ouse is a barrier to fish migration. To be addressed through Catchment Sensitive Farming Initiatives and implementation of Water Framework Directive. Major factor.	Bird species overwintering / on passage and feeding on mud dwelling invertebrates: subject to natural change, maintain in favourable condition the intertidal mudflats and sandflats, saltmarsh communities and coastal lagoons (for Shelduck, Dunlin, Knot, Redshank, Black-tailed Godwit, Bar-tailed Godwit, Golden Plover, Ruff and Avocet. Assemblage of non-breeding birds feeding on fish, mud dwelling invertebrates and vegetation: subject to natural change, maintain in favourable condition the intertidal mudflats and

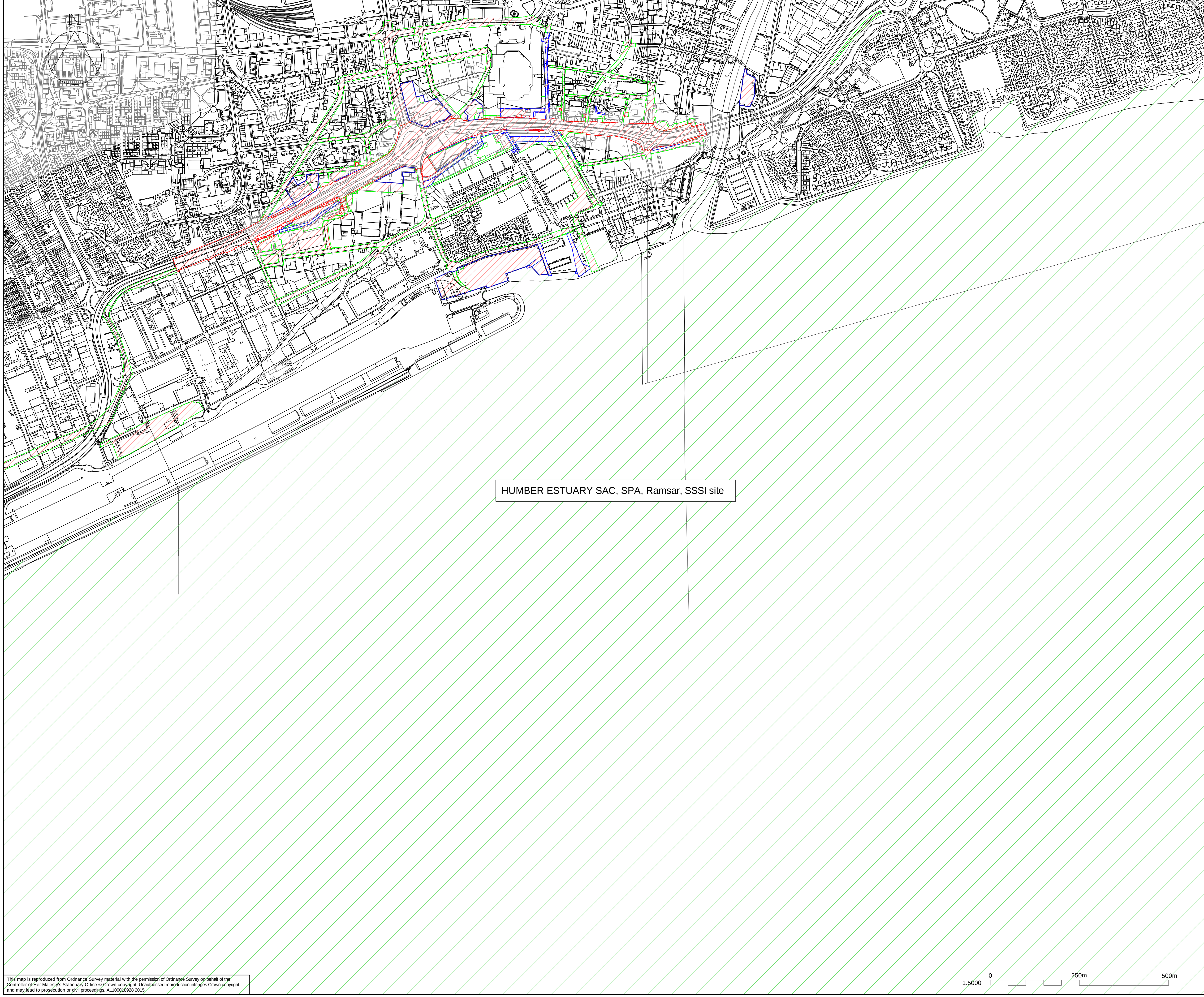
Name of European Site and EU code	Qualifying features	Vulnerabilities	Conservation objectives
	estuary and up into the tidal rivers. The lower saltmarsh of the Humber is dominated by common cordgrass Spartina anglica and annual glasswort Salicornia communities. Low to mid marsh communities are mostly represented by sea aster Aster tripolium, common saltmarsh grass Puccinellia maritima and sea purslane Atriplex portulacoides communities. The upper portion of the saltmarsh community is atypical, dominated by sea couch Elytrigia atherica (Elymus pycnanthus) saltmarsh community. In the upper reaches of the estuary, the tidal marsh community is dominated by the common reed Phragmites australis fen and sea club rush Bolboschoenus maritimus swamp with the couch grass Elytrigia repens (Elymus repens) saltmarsh community. Within the Humber Estuary Ramsar site there are good examples of four of the five physiographic types of saline lagoon. **Ramsar criterion 3** The Humber Estuary Ramsar site supports a breeding colony of grey seals *Halichoerus grypus* at Donna Nook. It is the second largest grey seal colony in England and the furthest south regular breeding site on the east coast. The dune slacks at Saltfleetby-Theddlethorpe on the southern extremity of the Ramsar site are the most north-easterly breeding site in Great Britain of the natterjack toad *Bufo calamita*.	• Coastal squeeze causing loss of intertidal habitats and saltmarsh due to sea level rise and fixed defences. The Humber Flood Risk Management Strategy has been developed and is being implemented. Major factor. • Disturbance to vegetation through cutting / clearing. Reedbeds being cut and cleared on margins of pits associated with angling. Management agreements and enforcement to address. • Vegetation succession. Lack of reedbed management leading to scrub encroachment. Management agreement to address. • Water diversion for irrigation/domestic/industrial use. Abstraction causes reduced freshwater input. Review of consents well advanced but not yet implemented. • Recreational/tourism disturbance (unspecified). Particularly illegal access by motorised recreational	sandflats, saltmarsh communities and coastal lagoons. Fish species migrating into or through the estuary: subject to natural change, maintain in favourable condition the habitat and migratory route (for River Lamprey and Sea Lamprey). Marine mammals feeding, resting and breeding in the estuary: subject to natural change, maintain in favourable condition the intertidal mudflats and sandflats (for grey seal). Subject to natural change, maintain in favourable condition the dune systems and humid dune slacks (Humber Estuary Ramsar site conservation objective for Natterjack Toad).

Name of European Site and EU code	Qualifying features	Vulnerabilities	Conservation objectives
	Ramsar criterion 5 Assemblages of international importance: 153,934 waterfowl, non-breeding season (5 year peak mean 1996/97-2000/2001) **Ramsar criterion 6 – species/populations occurring at levels of international importance.** Eurasian golden plover, *Pluvialis apricaria altifrons* subspecies – NW Europe, W Continental Europe, NW Africa population 17,996 individuals, passage, representing an average of 2.2% of the population (5 year peak mean 1996-2000) Red knot, *Calidris canutus islandica* subspecies 18,500 individuals, passage, representing an average of 4.1% of the population (5 year peak mean 1996-2000) Dunlin, *Calidris alpine alpina* subspecies – Western Europe (non-breeding) population 20,269 individuals, passage, representing an average of 1.5% of the population (5 year peak mean 1996-2000) Black-tailed godwit, *Limosa limosa islandica* subspecies 915 individuals, passage, representing an average of 2.6% of the population (5 year peak mean 1996-2000)	vehicles and craft. Control through management scheme. **Those factors that are not currently being managed, or where the regulatory regime appears to have been ineffective so far.** • Overfishing. Substantial lamprey by-catch in eel nets in River Ouse.	Estuarine habitats above high water: subject to natural change, maintain in favourable condition the coastal lagoons, annual vegetation of drift lines, embryonic shifting dunes, shifting dunes along the shoreline with Marram grass, fixed dunes with herbaceous vegetation and dunes with Sea Buckthorn. Estuarine habitats between high water and low water: subject to natural change, maintain in favourable condition the estuary, mudflats and sandflats not covered by seawater at low tide, saltmarshes, Salicornia and other annuals colonising mud and sand; Spartina swards and Atlantic salt meadows.

Name of European Site and EU code	Qualifying features	Vulnerabilities	Conservation objectives
	Common redshank, *Tringa totanus* brittanica subspecies 7,462 individuals, passage, representing an average of 5.7% of the population (5 year peak mean 1996-2000) Common shelduck, *Tadorna tadorna* Northwestern Europe (breeding) population 4,464 individuals, wintering, representing an average of 1.5% of the population (5 year peak mean 1996/7-2000/1) Eurasian golden plover, *Pluvialis apricaria altifrons* subspecies – NW Europe, W Continental Europe, NW Africa population 30,709 individuals, wintering, representing an average of 3.8% of the population (5 year peak mean 1996/7-2000/1) Red knot, *Calidris canutus islandica* subspecies 28,165 individuals, wintering, representing an average of 6.3% of the population (5 year peak mean 1996/7-2000/1) Dunlin, *Calidris alpine alpina* subspecies – Western Europe (non-breeding) population 22,222 individuals, wintering, representing an average of 1.7% of the population (5 year peak mean 1996/7-2000/1) Black-tailed godwit, *Limosa limosa islandica* subspecies 1,113 individuals, wintering, representing an average of 3.2% of the population (5 year peak mean 1996/7-2000/1)		Estuarine habitats below low water: subject to natural change, maintain in favourable condition the estuarine waters and sandbanks which are slightly covered by sea water all the time.

Name of European Site and EU code	Qualifying features	Vulnerabilities	Conservation objectives
	Bar-tailed godwit , *Limosa lapponica lapponica* subspecies 2,752 individuals, wintering, representing an average of 2.3% of the population (5 year peak mean 1996/7-2000/1) Common redshank, *Tringa tetanus brittanica* subspecies 4,632 individuals, wintering, representing an average of 3.6% of the population (5 year peak mean 1996/7-2000/1) **Ramsar criterion 8** The Humber Estuary acts as an important migration route for both river lamprey *Lampetra fluviatilis* and sea lamprey *Petromyzon marinus* between coastal waters and their spawning areas.		

Appendix B: Location of European Sites in Relation to the Scheme



Notes

Key to symbols

- PERMANENT LAND TAKE BOUNDARY
- PERMANENT RIGHTS BOUNDARY
- TEMPORARY LAND TAKE BOUNDARY
- SCHEME FOOTPRINT
- SITE COMPOUNDS

Rev	Date	Amendment Details	Drw'n	Chk'd	App'd
P03	14/09/18	SCHEME BOUNDARY EXTENTS AMENDED	VM	DW	LC
P02	16/08/18	ISSUED FOR HE APPROVAL	VM	DW	LC
P01	31/01/18	ISSUED FOR REVIEW & COMMENT	RE	DW	LC

Mott MacDonald Sweco

Client

highways england

Drawing Status: SHARED

Suitability: S4

Project Title: A63 CASTLE STREET IMPROVEMENTS, HULL

Drawing Title: STATUTORY DESIGNATED SITES

VOLUME 2 FIGURE 10.1

Scale	Designed	Drawn	Checked	Approved
1:5000	West, Adam	Ebbs, Ray	Wood, Diane	Cottrell, Linsey
Original Size: A1	Date: 31/01/18	Date: 31/01/18	Date: 31/01/18	Date: 31/01/18

Drawing Number
HE PIN | Originator | Volume
514508 - MMSJV - VES -
S0 - DR - LE - 000101
Location | Type | Role | Number

Project Ref. No.: 514508

Revision: P03

Appendix C: PINS Advice Note 10 Appendix 1 Screening Matrices

Potential Impacts

Potential impacts upon the European site(s) which are considered within the AIES Screening Report for the A63 Castle Street Improvements Scheme are provided in the table below.

Designation	Impacts in submission information	Presented in screening matrices as
Humber Estuary SAC	Pollution and scour of estuarine habitats via surface water discharge	Surface water discharge
	Contamination during construction of bridge, and dry dock	Dust, sediment and construction run-off
	Noise and vibration during construction of Wider Scheme, bridge and dry dock	Noise and vibration
	Air quality during construction and traffic during operation	Air emissions
	Contamination of groundwater	Groundwater contamination
	Impacts in combination of Wider Scheme and Princes Quay Bridge	In combination effects
	Pollution and scour of estuarine habitats via surface water discharge	Surface water discharge

Designation	Impacts in submission information	Presented in screening matrices as
Humber Estuary SPA	Contamination during construction of bridge, and dry dock	Dust, sediment and construction run-off
	Noise and vibration during construction of Wider Scheme, bridge and dry dock	Noise and vibration
	Air quality during construction and traffic during operation	Air emissions
	Contamination of groundwater	Groundwater contamination
	Impacts in combination of Wider Scheme and Princes Quay Bridge	In combination effects
Humber Estuary Ramsar site	Pollution and scour of estuarine habitats via surface water discharge	Surface water discharge
	Contamination during construction of bridge, and dry dock	Dust, sediment and construction run-off
	Noise and vibration during construction of Wider Scheme, bridge and dry dock	Noise and vibration
	Air quality during construction and traffic during operation	Air emissions
	Contamination of groundwater	Groundwater contamination
	Impacts in combination of Wider Scheme and Princes Quay Bridge	In combination effects

Stage 1: Screening Matrices

The European Sites included within the screening assessment are:

- Humber Estuary SAC
- Humber Estuary SPA
- Humber Estuary Ramsar site

Evidence for likely significant effects on their qualifying features is detailed within the footnotes to the screening matrices below.

Matrix Key:

✓ = Likely significant effect **cannot** be excluded ✗ = Likely significant effect **can** be excluded

C = construction O = operation D = decommissioning

Where effects are not applicable to a particular feature the matrix cell is formatted as follows: n/a

Stage 1 Matrix 1: Humber Estuary SAC

Name of European Site and designation: Humber Estuary SAC																		
EU Code: UK0030170																		
Distance to NSIP: 90m (nearest point of Wider Scheme) 295m (Princes Quay Bridge piling footprint)																		
European site features	**Likely effects of proposed development**																	
Impact	*Surface water discharge (Wider Scheme and Princes Quay Bridge)*			*Dust, sediment and construction run-off (Princes Quay Bridge)*			*Noise and vibration (Wider Scheme and Princes Quay Bridge)*			*Groundwater Contamination (Wider Scheme)*			*Air Emissions (Wider Scheme)*			*In combination effects (Wider Scheme and Princes Quay Bridge)*		
Stage of development	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Annex I habitats:																		
1130 Estuaries	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
1140 Mudflats and sandflats not covered by seawater at low tide	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a

1110 Sandbanks which are slightly covered by sea water all the time	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
1150 Coastal lagoons	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
1310 Salicornia and other annuals colonizing mud and sand	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
1330 Atlantic salt meadows (Glauco-Puccinellietalia maritimae)	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
2110 Embryonic shifting dunes	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
2120 "Shifting dunes along the shoreline with Ammophila arenaria	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a

(""white dunes"")"																	
2130 "Fixed coastal dunes with herbaceous vegetation (""grey dunes"")" * Priority feature	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
2160 Dunes with *Hippophae rhamnoides*	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
Annex II species:																		
1095 Sea lamprey *Petromyzon marinus*	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
1099 River lamprey *Lampetra fluviatilis*	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
1364 Grey seal *Halichoerus grypus*	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a

Stage 1 Matrix 2: Humber Estuary SPA

Name of European site and designation: Humber Estuary SPA																	
EU code: UK9006111																	
Distance to NSIP: 90m (nearest point of Wider Scheme) 295m (Princes Quay Bridge and piling footprint)																	
European site features	**Likely effects of proposed development**																
Impact	*Surface water discharge (Wider Scheme and Princes Quay Bridge)*			*Dust, sediment and construction run-off (Princes Quay Bridge)*			*Noise and vibration (Wider Scheme and Princes Quay Bridge)*			*Groundwater Contamination (Wider Scheme)*			*Air Emissions (Wider Scheme)*			*In combination effects (Wider Scheme and Princes Quay Bridge)*		
Stage of development	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
ARTICLE 4.1 QUALIFICATION (79/409/EEC):																		
During breeding season the area regularly supports:	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a

Bittern, Marsh Harrier, Avocet, Little Tern.																	
Over winter the area regularly supports: Bittern, Hen Harrier, Bar-tailed Godwit, Golden Plover, Avocet	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
On passage the area regularly supports: Ruff	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
ARTICLE 4.2 QUALIFICATION (79/409/EEC):																		
Over winter the area regularly supports: Dunlin, Knot, Black-tailed	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a

Godwit, Common Shelduck, Redshank.																	
On passage the area regularly supports: Dunlin, Knot, Black-tailed Godwit, Redshank	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
In the non-breeding season the area regularly supports: 153934 waterfowl	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a

Stage 1 Matrix 3: Humber Estuary Ramsar site

Name of European site and designation: Humber Estuary Ramsar Site																		
EU Code: UK11031																		
Distance to NSIP: 90m (nearest point of Wider Scheme) 295m (Princes Quay Bridge and piling footprint)																		
European site features	**Likely effects of proposed development**																	
Impact	*Surface water discharge (Wider Scheme and Princes Quay Bridge)*			*Dust, sediment and construction run-off (Princes Quay Bridge)*			*Noise and vibration (Wider Scheme and Princes Quay Bridge)*			*Groundwater Contamination (Wider Scheme)*			*Air Emissions (Wider Scheme)*			*In combination effects (Wider Scheme and Princes Quay Bridge)*		
Stage of development	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D	C	O	D
Ramsar criteria (see Appendix A for detail):																		
Ramsar criterion 1 An example of near natural beauty	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a

Ramsar criterion 3 Supports populations of animal species important for maintaining the biological diversity of a region (grey seal and natterjack toad)	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
Ramsar criterion 5 Regularly supports 20,000 or more waterbirds	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a
Ramsar criterion 6 Supports populations of waterbirds at	×a	×a	n/a	×b	n/a	n/a	×c	×c	n/a	×d	n/a	n/a	×e	×e	n/a	×f	×f	n/a

levels of international importance																	
Ramsar criterion 8 Important migration route for river lamprey and sea lamprey	✕a	✕a	n/a	✕b	n/a	n/a	✕c	✕c	n/a	✕d	n/a	n/a	✕e	✕e	n/a	✕f	✕f	n/a

Evidence supporting conclusions:

a. Surface water from the Scheme would be discharged to the existing public sewer network at the existing flow rates. A network of on-site water collection attenuation features will retain any additional surface water/run-off.

b. Contamination during construction of Princes Quay Bridge and dry dock including dust, sediment and construction run-off. The high dilution within the Humber Estuary will disperse the sedimentation and contamination (Appendix E Hydrology and water quality technical note).

c. Noise and vibration during construction and operation of the Scheme and Princes Quay Bridge. The prediction of ground-borne vibration from construction activities such as piling and vibratory compaction indicates the potential for perceptible levels of vibration at receptors within 30m of the works. The Humber Estuary is approximately 70m at the nearest point from the works on the wider Scheme at the River Hull and no effects from ground-borne vibration during construction are predicted. Impacts due to ground-borne vibration from road traffic during operation can be scoped out of the assessment as the surface of the carriageway would be renewed and be constructed to be free of discontinuities. The wider Scheme site does not contain habitats that support bird species which the Humber Estuary is designated for, so airborne construction noise would have no impacts. Construction and operation noise will be airborne and would have no impacts upon the habitats of the Humber Estuary, lamprey or grey seals as the wider Scheme is a greater distance from the Humber Estuary than Princes Quay Bridge and noise and vibration from piling at Princes Quay Bridge has been screened out (Appendix F Noise and vibration technical note).

d. Contamination of groundwater from the Scheme. The degree of hydraulic connectivity between groundwater at the development site and the Humber Estuary is likely to be very limited and the zone of influence for the underpass construction is small and does not extend to the estuary.

e. Air quality during construction and traffic during operation of the Scheme. Total nitrogen deposition is below the critical load range in all scenarios, and the change in deposition associated with the wider Scheme is less than 1% of the critical load. These air quality effects and the wider Scheme impacts are concluded to be not significant for ecological receptors based on the magnitude of increase and because the flushing action due to tides is likely to reduce the input of atmospheric nitrogen (N) to the saltmarsh ecosystem.

f. No likely cumulative effects of the A63 Castle Street Improvement Scheme in combination with the Princes Quay Bridge were identified.

Appendix D: Ecology Baseline

Habitat

In February, June and August 2013, MMSJV ecologists undertook Extended Phase 1 habitat surveys within the wider Highways England A63 Castle Street Improvements site boundary and also at the potential compound sites that were proposed at the time. Additional compound sites were surveyed in March 2014.

Since then, the A63 Castle Street Improvement site boundary and the proposed compound sites have changed and the area within the new site boundary has been re-surveyed. This was undertaken on 24 May and 07 September 2016 and 14 September 2017.

The survey established that the part of the site in which Princes Quay Bridge is to be located consisted of amenity grassland, introduced scrub, the standing waters of Princes Quay and Hull Marina and hardstanding. The standing waters of Princes Quay and Hull Marina is NERC Act 2006 Section 41 Broad Habitat Inventory – Intertidal Substrate foreshore (Made Ground) habitat but it is not part of the Humber Estuary SAC/SPA/Ramsar site.

The survey demonstrated that there were no trees or structures within the site that contained bat roost potential, but to support the A63 Castle Street Improvements Scheme EIA, bat activity transect surveys and commuting route surveys were completed. Automated detectors were deployed between June and September 2013 to monitor the level and pattern of bat activity within and adjacent to the Scheme, including in the vicinity of Princes Quay Bridge. Further bat activity surveys were undertaken in August and September 2015 and July, August and September 2016. Findings from the surveys concluded that the part of the transect where the bridge is to be located was not considered an important commuting route or foraging area. Bats were not observed foraging over the water in either of the docks.

Birds

A suite of four breeding bird surveys were undertaken for the A63 Castle Street Improvements in May and June 2016. This included the locations of two of the potential site compounds for the Scheme that are relevant to this assessment. These sites contained suitable habitats for the bird species (for which the Humber Estuary is designated), to breed, roost or forage in and are adjacent to the Estuary. One of the sites was at Wellington Street Island Wharf which is closest to Hull Marina (approximately 100m at the nearest point between the compound and the dock gates) and one on the River Hull (approximately 550m at the nearest point between the compound and the dock gates, although not part of the European Site). The surveys established that the area where the bridge will be located has no suitable habitat for birds to breed in. No species that the European Site is designated for were recorded breeding in either of the sites. Neptune Street, where the main compound for the development is proposed to be sited, was not proposed as a site compound for the Improvements Scheme at this time and consequently

breeding bird surveys were not completed. In January and February 2017, four wintering bird surveys were undertaken at Neptune Street, Wellington Street Island Wharf and the River Hull. Wellington Street Island Wharf recorded 24 species, with one species Mallard *Anas platyrhynchos* that is a qualifying species for the Humber Estuary SPA being observed in a group of eight flying above and around the site and the River Humber in February. The closest SPA qualifying bird species were recorded on the River Hull, with up to ten redshank *Tringa totanus* seen and heard on the mudflats approximately 600m from the location of Princes Quay Bridge in January and February 2017. The site at Neptune Street recorded 23 species, with one species noted- mallard, a qualifying species for the SPA. A pair was observed flying over and around the site.

Cetaceans

Although no dedicated surveys were undertaken for cetaceans, there are no records of them in either Hull Marina or Railway Dock (both constitute Hull Marina), just records of cetacean sightings and strandings in the Humber Estuary from Seawatch Foundation[7] June 2018 and National Biodiversity Network (NBN) Gateway (public access)[8] 1993. As the lock gates are only opened when a boat is entering or exiting and then closed again afterwards, cetaceans are unlikely to be present within the docks unless they entered accidentally.

Grey seals

Grey seals *Halichoerus grypus* use the Humber Estuary for foraging and haul-out. The population at Donna Nook approximately 40km from the development, is estimated to have trebled between 2005 and 2014[9]. However, there are no records available of sightings of seals in the Hull Marina, with their presence unlikely due to the restrictions imposed by the lock gates.

Lamprey and other fish species

River lamprey *Lampetra fluviatilis* are much more frequent in the Humber Estuary than sea lamprey *Petromyzon marinus*. A total of 616 river lamprey individuals and two individual sea lamprey were caught between 2000-2012 in power station impingement data[10]. The docks within and adjacent to the site are unlikely to support spawning river or sea lamprey as they are saltwater and lamprey spawn in freshwater further upstream of the docks. The eggs hatch and the larvae (ammoceates) float into sheltered silty areas of the freshwater river. After a period in freshwater, the larvae undergo a metamorphosis into sexually mature non-feeding adults and they migrate downstream to estuaries and coastal areas. The migration is usually nocturnal and in the Humber Estuary this occurs in spring and

[7] Seawatch Foundation. Available online at: http://www.seawatchfoundation.org.uk/recentsightings/ (Accessed December 2017).

[8] NBN Gateway. Available online at: https://nbnatlas.org/ (Accessed December 2017).

[9] Jones, E.L & Russell, D.J.F (2016). Updated grey seal (*Halichoerus grypus*) usage maps in the North Sea. Report for the Department of Energy and Climate Change (OESEA-15-65).

[10] Institute of Estuarine and Coastal Studies (2011). *Assessment of potential impacts of Able Marine Energy Park (AMEP) on sea and river lamprey in the Humber Estuary*. University of Hull.

early summer. Lamprey then spend 2-3 years in the marine environment before migrating back upstream past the docks to spawn in freshwater rivers in late summer and autumn.

Common fish species are recorded on NBN Gateway in the Humber Estuary along with European eel *Anguilla Anguilla*. Migrating lamprey species, European eel and common fish species may all be present in the Hull Marina areas however BWML do not keep records of fish in the marina.

No works are to take place in Princes Dock however records were received from Realm Ltd who manage Princes Quay. In 2010, European eel, perch *Perca fluviatilis* and tench *Tinca tinca* were present in Princes Dock. In addition, in 2010, an order for ornamental ghost carp, rudd and gold orfe was placed by Realm Ltd and the fish released into the dock.

Appendix E: Hydrology and water technical note

Project:	A63 Castle Street Improvements – Princes Quay Bridge		
Document title:	Hydrology and Water Quality Technical Note: Assessment of Impact on European Sites		
Document ref:	HE514508-MMSJV-EWE-S0_BR_PQB-RP-LE-000001	**Revision:**	v4.0
Author:	Stephen Hughes	**Date:**	10/06/2018
Checker:	Jason Ball	**Date:**	10/06/2018
Approver:	Adela Sadler	**Date:**	10/062018

1 Summary

This document provides a high-level technical review of the hydrological links between the proposed construction of the Princes Quay Bridge and the Humber Estuary Special Protection Area/Special Area of Conservation/Ramsar site via Railway Dock and the Humber Dock Marina. The purpose of the document is to evaluate whether a construction related spill, pollution event or sediment disturbance would have a significant impact on the Humber Estuary European Sites.

Consultation was undertaken with British Waterways Marinas Limited (BWML) who are the owners and operators of both the Railway Dock and the Humber Dock Marina. Technical information regarding the nature of the hydrological pathways between the docks and the Humber Estuary European Sites was obtained and reviewed.

The review concluded that the degree of dilution of any construction related pollution or sediment disturbance would mean that any impact on the European Sites would be negligible.

2 Introduction

The purpose of this technical note is to review and evaluate the presence of any hydrological pathways between the Railway Dock and Humber Dock Marina and the Humber Estuary.

It is proposed to construct the southern foundations of the Princes Quay Bridge adjacent to the existing northern wall of the Humber Dock Marina. This construction would take the form of the installation of many piles (17 concrete piles and 16 steel piles) within the Humber Dock Marina to form the foundations of the Princes Quay Bridge.

The proposed Princes Quay Bridge final layout is shown in Figure 1 and Figure 2. Foundations for the bridge and a new extended paved deck area with seating, ramps and steps are to be constructed, both onto concrete piled foundations. This new area will extend approximately 8m into the Humber Dock Marina from the existing dock wall.

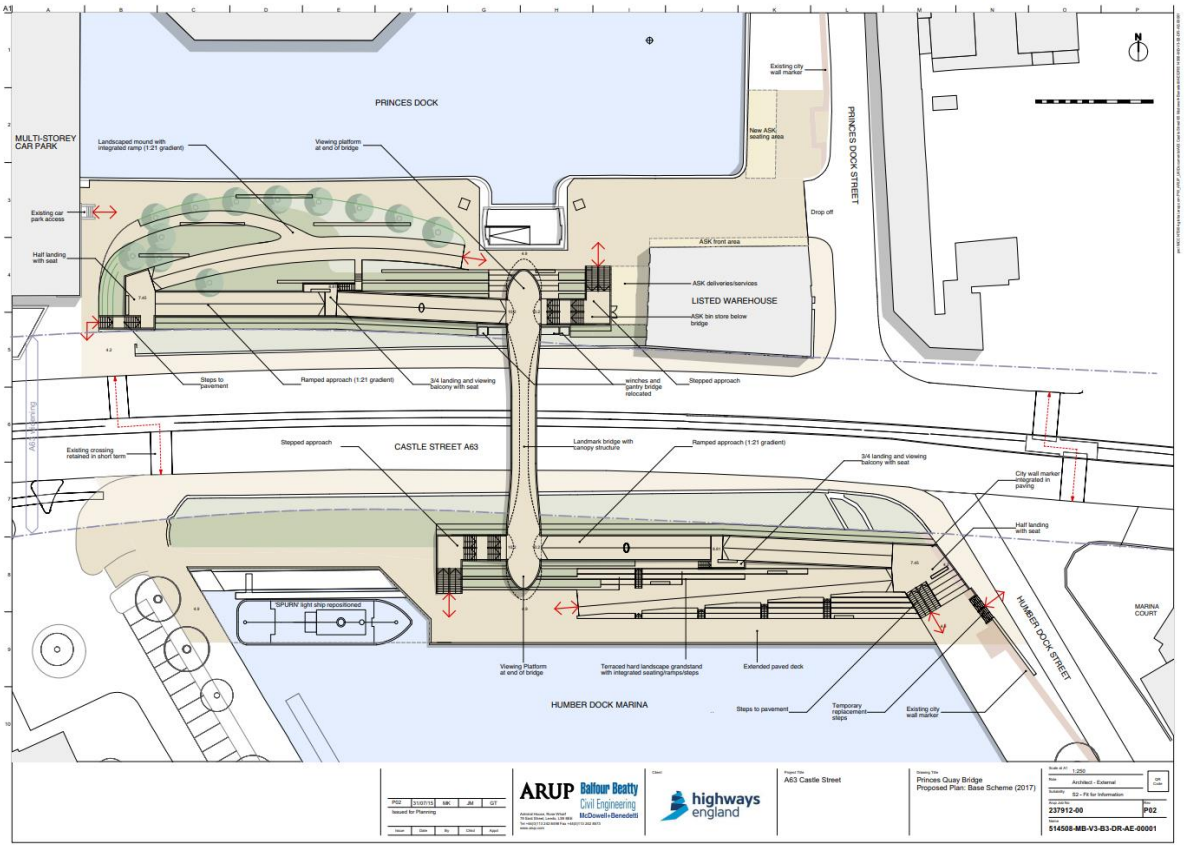


Figure 1: Princes Quay Bridge general arrangement plan

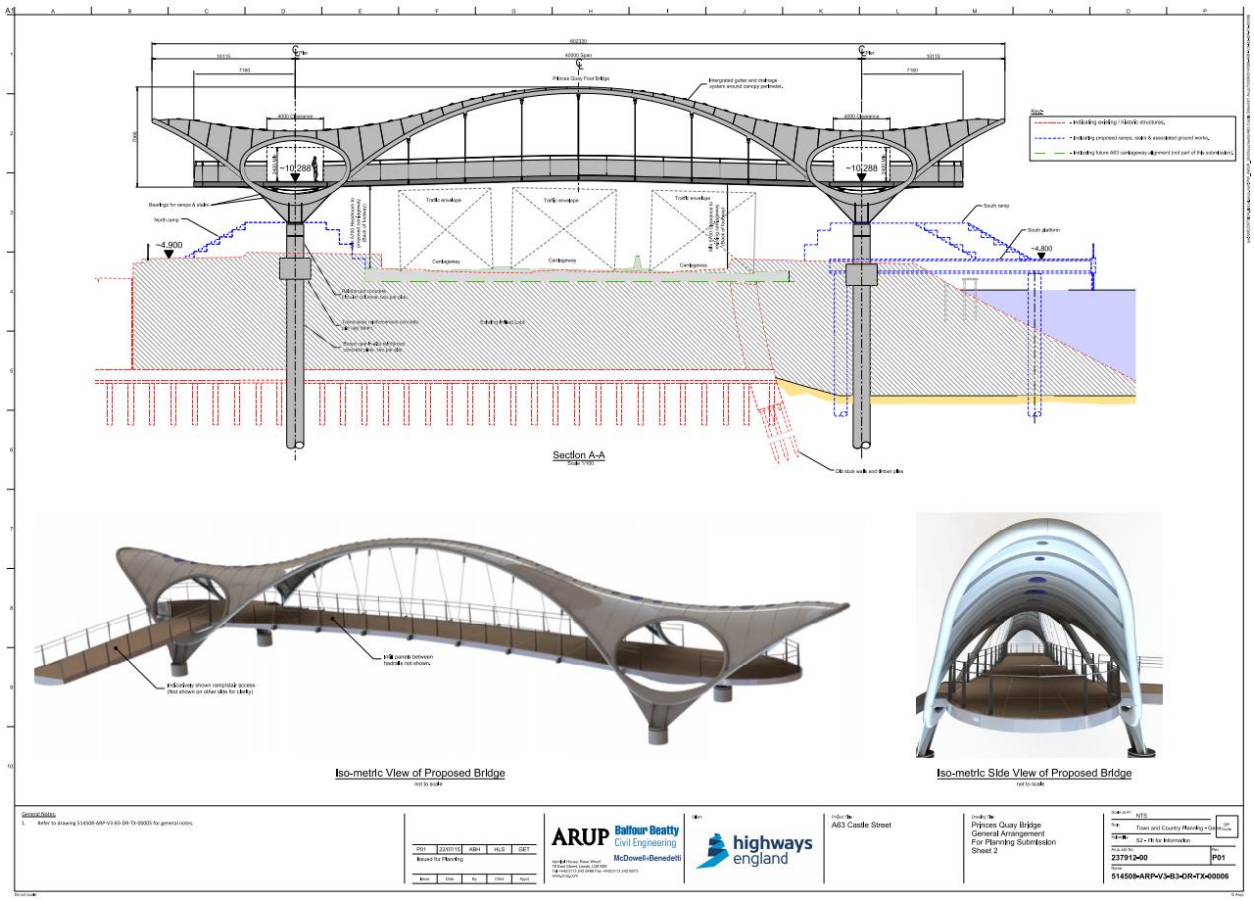


Figure 2: Princes Quay Bridge general arrangement sections

During construction of Princes Quay Bridge, there is a risk of contamination of the surface water within the docks either from disturbance of sediment, direct contamination from construction / piling activities within the marina or due to a spillage of construction related materials such as oils, fuels, chemicals, concrete, bentonite slurry, cement or admixtures.

The ability of such an event to impact on the Humber Estuary European protected sites is dependent on the nature of the hydrological pathways between the construction site within Humber Dock Marina and the Humber Estuary. Figure 3 shows a plan of the Scheme in relation to the boundary of the European protected sites.

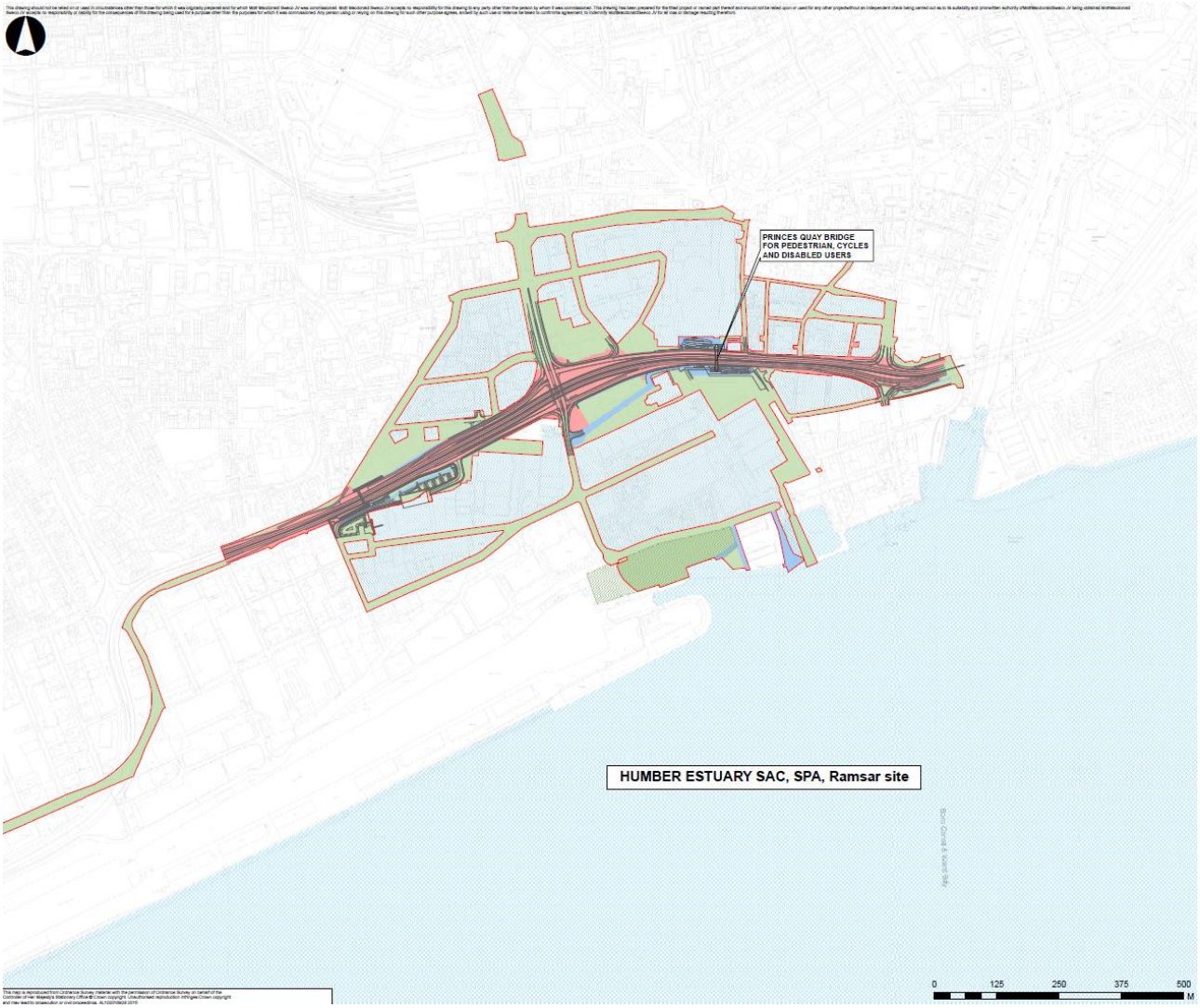


Figure 3: Princes Quay Bridge in relation to the location of the Humber Estuary European protected sites

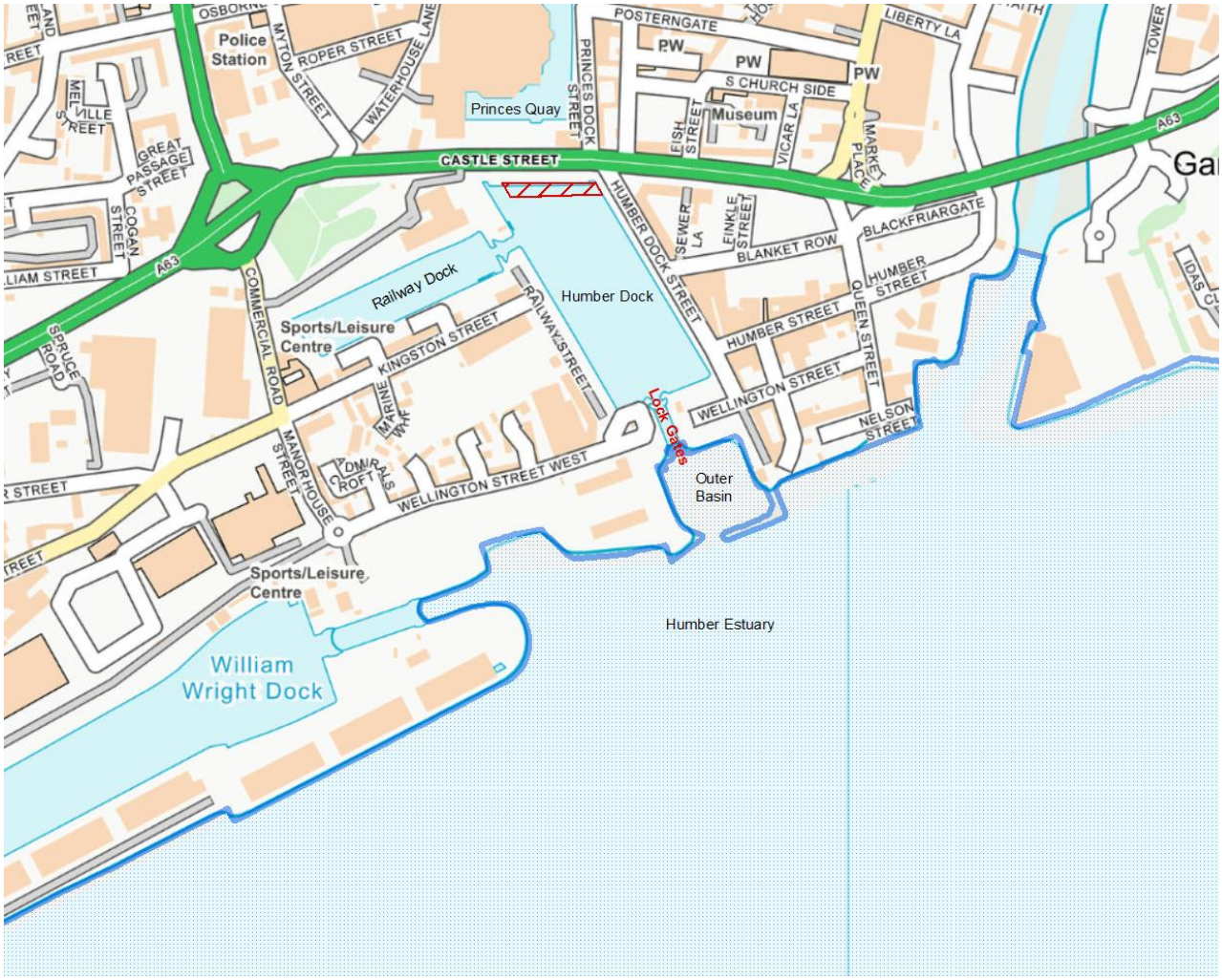
2.1 Description of existing Railway Dock and Humber Dock Marina layout and operation

Consultation with David Parkinson of BWML (email dated 13 June 2018) indicated the following about the existing layout and operation of the Railway Dock and Humber Dock Marina. An indicative layout plan of the marina and lock gates is provided in Figure 4.

- The entire marina has berthing available for up to 220 vessels and these berths are currently 90% full. Most vessels are for leisure use.
- The marina users access the Humber Estuary via a pair of lock gates which open into an outer basin area which in turn is joined directly (without lock gates) to the Humber Estuary.

- There are no lock gates between Railway Dock and Humber Dock although there is a swing bridge for pedestrian traffic.
- The dimensions of the lock gates connecting Humber Dock Marina and the outer basin area are 36.5m length by 7.6m width. Depth within the lock gates is dependent on operation and tide levels.
- The dimensions of the Railway Dock Marina (estimated from Ordnance Survey mapping) are 211m length by 48m width.
- The dimensions of the Humber Dock Marina (estimated from Ordnance Survey mapping) are 278m length by 102m width.
- The depth of water in the marina is maintained at approximately 5m. This is, in part, achieved using two impound pumps which operate automatically to maintain the marina level.
- The dimensions of the outer basin (estimated from Ordnance Survey mapping) are 91m width by 90m length. The depth of water within the basin is unknown although this will be dependent on tide levels.
- As a 'general rule' the lock gates are operated for three hours either side of High Water. Within this timeframe, vessels enter and exit the Marina as required and during busy periods, this can mean that the lock gates and constantly in use for a period of six hours.
- As the vessels are the main leisure users, lock operations tend to be more frequent during school holidays and weekends. The most vessel movements occur during the sailing seasons with significantly fewer movements in the winter.
- A typical full lock operation takes up to 15 minutes.
- The lock gates are very rarely operated at low tide 'slack water[1]'. If operations are required during 'slack water' then these are carried out under the supervision of lock engineers from Hull City Council.

[1] 'slack water' is used to refer to the state of the tide when it is turning, especially at low tide



OS_Open_Raster - Contains OS data © Crown Copyright and database right 2017

Figure 4: Layout of the Railway and Humber Dock marina (red hatch indicates area of proposed construction for Princes Quay Bridge; blue line indicates the boundary of the Special Protection Area)

3 Assessment

3.1 Estimated marina volumes and exchanges with Humber Estuary

Based on the above marina and lock dimensions, it was possible to estimate the volume of water within both the Railway and Humber Dock marinas and the lock gates during normal operational conditions. These are summarised in Table 1 below.

Table 1: Estimated marina and lock volumes

	Width (m)	Length (m)	Normal depth (m)	Normal volume (m^3)
Railway Dock Marina	48.0	211.0	5.0	50,640
Humber Dock Marina	102.0	278.0	5.0	141,780
Lock gates	7.6	36.5	5.0	1,387
Estimated lock gate flow rate	Typical operation time (minutes)			15.0
	Outer gates open (half of typical operation time) (minutes)			7.5
	Outer gates open (half of typical operation time) (seconds)			450.0
	Typical lock exchange flow rate (m^3/second)			3.1

Based on the above estimates, the total marina volume would be approximately 192,420m^3 and a single lock operation would result in the loss / exchange of 0.7% of the total marina volume with the outer basin.

From consultation with BWML it is known that the use of the lock gates and marina is seasonal with significantly less use during the winter months.

During the busiest period of lock operation there would be approximately 24 operations (1 every 15 minutes for a period of 6 hours). During such a period, there would be a total exchange of volume through the lock gates of approximately 33,288m^3 equivalent to approximately 17% of the total marina volume. Note that this would represent a worst-case condition.

A 'normal' period of lock operation has been assumed to be at 25% of the maximum lock capacity (i.e. 6 operations consisting of 1 operation every hour for 6 hours). During such a period, there would be a total exchange of 8,322m^3 equivalent to approximately 4% of the marina volume.

It is assumed that during this time, there would be a return of volume into the Marina via the two impound pumps which operate automatically to maintain water levels within the Marina. However, the pump capacities are unknown and so it not possible to estimate the volume of water being returned to the marina via the pumps. However, it is assumed the capacity of the pumps is sufficient to replace water lost via the locks to maintain water levels in the marina.

3.2 Estimated normal flow rate in Humber Estuary

An estimation of a worst-case tidal flow in the Humber Estuary was carried out based on the minimum velocity recorded at the UK Hydrographic Office Albert Dock tidal stream diamond which is 0.051 m/sec (Table 2). It is assumed that the contribution from fluvial

flow is negligible (i.e. assuming a worst case low summer river flow). Table 2 lists mean velocity and direction for spring and neap tides at times relative to High Water at Immingham. All the information below is published on Admiralty Chart 3497 which covers the Humber Estuary from Immingham to the Humber Bridge.

Table 2: Average velocity and direction of tidal flows during a spring and neap tide. Data supplied by UK Hydrographic Office[2]

Time	Direction	Spring Rate		Neap Rate	
		Knots	m/sec	Knots	m/sec
-06h	063°	3.3	1.698	1.5	0.772
-05h	064°	2.2	1.132	0.1	0.051
-04h	241°	2.8	1.440	2	1.029
-03h	243°	5	2.572	3.2	1.646
-02h	245°	4.5	2.315	3.8	1.955
-01h	240°	3.7	1.903	2.7	1.389
HW	239°	1.8	0.926	1.5	0.772
+01h	103°	0.7	0.360	0.1	0.051
+02h	068°	3.1	1.595	1.2	0.617
+03h	067°	3.3	1.698	2.3	1.183
+04h	066°	3.4	1.749	2.3	1.183
+05h	063°	3.1	1.595	2.6	1.338
+06h	063°	3.5	1.801	1.9	0.977

The River Humber in the reach to the south of the Scheme near the Humber Dock Marina splits into two channels at low tide (see Figure 5). The dimensions (width and depth) of the channel passing by the north bank of the river in the area of discharge were obtained from Ordnance Survey maps and literature. The channel width in this section was measured as 650m. In the Humber Estuary History article, published by Associated British Ports on their website[3], it is stated that the depth of the river channel in the area of Hull is around 9m. According to Humber Nature Partnership[4] the average depth across the estuary is 6.5m. In view of this information it is reasonable to assume that the depth in the Humber Estuary adjacent to the Humber Dock Marina is around 6m; this represents a worst-case scenario in terms of dilution.

[2] UK Hydrographic Office. Admiralty Chart 3497: England, East Coast, River Humber, Immingham to Humber Bridge and the Rivers Ouse and Trent

[3] http://www.humber.com/

[4] http://www.humbernature.co.uk/estuary/index.php

World Imagery - Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID,IGN, and the GIS User Community

Figure 5: Plan of Humber Estuary south of Humber Dock marina

Using the tidal velocities (Table 2) and the estimated dimensions of the Humber Estuary outlined above, it was possible to estimate a typical flow rate. It should be noted that this represents an extremely conservative estimate of low flow and as such would represent a minimum level of dilution during a neap tide. Furthermore, the tidal velocity would reach a maximum three to four hours after neap tide, which would act to provide further dilution within the Humber Estuary. The flow estimates are provided in Table 3.

Table 3: Humber Estuary flow assessment

Humber Estuary flow assessment		Units	Value
Input Data			
Tidal velocity (v)	Minimum neap tide velocity	m/sec	0.051
Estuary / channel dimensions assuming a trapezoidal shape	Width (surface)	m	650
	Width (bottom)	m	600
	Depth	m	6
Calculations			
Minimum flow in estuary	(6 x (650 + 600) / 2 x 0.051 x 1000	l/sec	191,250
Minimum flow in estuary	-	m^3/sec	191.25

3.3 Effect of a construction related spill or contamination event on the Humber Dock Marina and European protected sites

In the event of sediment disturbance or a spill of construction related materials such as oils, fuels, chemicals, concrete, bentonite slurry, cement or admixtures, there would be direct contamination of the water within the Railway Dock and Humber Dock Marina.

Table 1 shows an estimated typical flow rate from the Marina lock gates of 3.1 m^3/sec compared to an estimated worst-case low tidal flow of 191.3 m^3/sec. Therefore, water entering the Humber Estuary from the lock gates would be diluted by a factor of 61 times during low tidal flows. The dilution outlined above would be in addition to the dilution of any sediment disturbance or construction related spill within the Humber and Railway Dock Marina prior to exchange with the Humber Estuary via the locks.

As such, a sediment disturbance, construction related spill or pollution event is unlikely to have a significant impact on the Humber Estuary European protected sites due to the high degree of dilution within the Marina and within the Estuary.

4 Conclusion

The purpose of this technical note was to review and evaluate the presence of any hydrological pathways between the Railway Dock and Humber Dock Marina and the Humber Estuary and to understand the potential for sediment disturbance, construction related spills or pollution events to impact on the European protected sites designated at the Humber Estuary.

During construction of Princes Quay Bridge or any construction adjacent to or within the marina, there is a risk of sediment disturbance or contamination of the surface water within the docks either directly from construction / piling activities within the marina or due to a spillage of construction related materials such as oils, fuels, chemicals, concrete, bentonite slurry, cement or admixtures.

The ability of such an event to impact on the Humber Estuary European protected sites is dependent on the nature of the hydrological pathways between the construction site within Humber Dock Marina and the Humber Estuary.

Consultation was carried out with BWML to ascertain the existing dimensions and operational characteristics of the Railway and Humber Dock Marina and the lock gates which link the marina to the Humber Estuary. Using information obtained during consultation, it was possible to estimate typical volumes and rates of exchange of water between the marina and the Estuary.

The results of the above assessments concluded that the degree of dilution of any construction related sediment disturbance or pollution within the Marina and the Humber Estuary would be sufficient to reduce the impact on the European Sites to a negligible level.

Appendix F: Noise and Vibration Technical Note

Project:	A63 Castle Street Improvements – Princes Quay Bridge		
Document title:	Noise and Vibration Technical Note: Assessment of Impact on European Sites		
Document ref:	HE514508-MMSJV-ENV-S0-RP-LA-000005	**Revision:**	v1.2
Author:	Stuart Dyne	**Date:**	24/07/2018
Checker:	Stuart Dyne	**Date:**	24/07/2018
Approver:	Adela Sadler	**Date:**	30/07/2018

1 Summary

This document provides a high-level technical review of the likely effect on birds of airborne noise and on seals and fish to underwater noise, in particular the wading birds on the mudflats and the lamprey and seals that populate the Humber Estuary Special Protection Area/Special Area of Conservation/Ramsar via Railway Dock and the Humber Dock Marina. The purpose of the document is to evaluate the impact of piling activities to determine if this would have a significant effect on these species.

The assessment shows that wading birds are unlikely to be affected by piling noise and that lamprey may be affected by piling only if they stay trapped within the marina for a prolonged period as they are classified as species without-a-swim-bladder. Any seals trapped within the marina would be likely to suffer a temporary threshold shift (hearing injury).

Potential impact on individuals or very low numbers would not have a significant effect on the favourable conservation status of grey seals, birds or lamprey as qualifying features. (Notwithstanding this, survey for grey seals will be undertaken to minimise potential for any effect whatsoever prior to piling commencing, in line with good nature conservation practice).

2 Introduction

Construction noise can affect animal behaviour where it masks sounds that are important to their ecology. Examples include impacts on breeding behaviour and prey-predator interaction [4] At higher noise levels noise can lead to recoverable injury to the hearing organs and, in the case of underwater noise at very high levels, to mortality.

Piling activity produces noise both in air and underwater. The airborne noise may affect birds, while the underwater noise may affect both fish and seals.

Birds vary in their sensitivity to noise according both to species and depending on whether the noise is continuous (as in the case of highway noise) or intermittent (as in the case of impact piling) [4].

While most fish have ears (otolithic organs), species vary in their sensitivity to underwater noise. One of the predominant factors that influences the effect of noise on fish is the

presence or absence of a gas bladder in the body and its anatomical location within the fish [1].

While the presence of a swim bladder generally increases acoustic sensitivity (by transmission of sound energy to the otolithic organs) it also increases the susceptibility to injury. Lamprey do not have a swim bladder and do not have otolithic organs [2] so are less sensitive to noise but may be sensitive to vibration.

Mammals exposed to underwater noise have been classified into hearing groups that depend on their generalised hearing range [3] in which seals belong to the Phocid pinniped group.

3 Units to describe noise

Acoustic pressure is the scalar variation in pressure about a mean value and has units of Pa but is conventionally converted to a decibel scale with a reference value p_0 of 20 x 10^{-6} (μPa) for airborne noise and 1 x 10^{-6} (1μPa) for underwater noise. That is, a pressure variation p becomes a pressure level L using the formula $L=20\log(p/p_0)$.

Underwater, the particle velocity is a vector quantity (having both value and direction) and has units m/s or mm/s. Velocity is one of several entities that can be used to express particle motion (as displacement, velocity, or acceleration) but these are all directly related to each other through differential calculus. Away from the surface, river bed and acoustic sources, the acoustic pressure and particle velocity are directly proportional to each other. Moreover, as there is currently a paucity of data on the sensitivity of animals to particle motion, all criteria are expressed in terms of acoustic pressure and not particle motion.

Acoustic pressure varies continuously with time so no single-number entity can be used to fully describe noise. For airborne noise one of the main entities that is used is the equivalent sound pressure level $L_{Aeq,T}$ that is a steady noise with the same mean square sound pressure as a time varying noise over period T. The entity is A-weighted to correspond to the relatively low sensitivity of human ears to very low and high frequencies and while this is not directly applicable to birds, standard calculation procedures such as BS5228-1 [5] have been developed to estimate A-weighted values and some bird sensitivity criteria are reported in terms of A-weighed values [4].

The statistical quantities that are often used to describe underwater noise in the context of exposure of fish and mammals are the sound exposure level (SEL) and peak sound pressure level. The SEL is the mean square value of the acoustic pressure normalised to a period of 1s and converted to a decibel quantity (with reference unit of 1μPa^{2}s) and the peak sound pressure level is the peak pressure converted to a decibel quantity (with reference unit of 1μPa). The SEL is often used to characterise the exposure of a transient noise event such as the strike of a hammer in piling. In this case, where there is a number (N) of similar events, each with sound exposure level SEL_{ss}, then the total, or cumulative noise exposure is $SEL_{cum}=SEL_{ss}+10\log(N)$.

For Phocid pinnipeds underwater noise exposures may be expressed in terms of $L_{E,PW}$ which is the frequency weighted exposure over 24 hours and where the frequency weighting performs a similar function to the A-weighting for sound in air for humans but is specific to this particular hearing group. The US National Marine Fisheries Service provides a simple weighting factor adjustment that can be used in lieu of the auditory weighting function [6].

Noise levels fall with distance from the source. In the case of airborne noise BS5228-1 [5] has a simple propagation model that shows that attenuation from a point source over hard ground at a distance R (in [m]) from 10m is given by 20log(R/10). This means that the attenuation to a distance of 600m – the approximate distance from the piling to the SPA mudflats – would be approximately 36dB. There is a second potential location for wading birds on the mudflats near the Old Harbour at the Outer Humber Basin. This is approximately 310m from the piling. The attenuation to a distance of 310m is 30dB.

Underwater, the model used in the Green Port Hull assessment [7] is $TL=\beta\log(r)+\alpha r$ where the coefficient of the log term, β, is given as 17.91 (with a standard deviation of 3.05) and the α term is 0.00523 dB/m (with a standard deviation of .00377 dB/m). These figures are based on a compilation of observations made by the Environment Agency. The β term corresponds to attenuation by spreading – it would be 20 for purely spherical spreading and 10 for cylindrical spreading. Within the predominantly enclosed area of the marina noise levels will decay at the same rate but reflections from the marina sides and floating craft will produce reflections of noise so that noise levels will be higher than this simple model predicts depending on the reflection coefficient of the reflecting surfaces. For the purposes of this assessment it will be assumed that these additional reflections increase the mean square sound pressure by a factor of 2 which increases the sound pressure level by 3dB.

4 Effects of sound exposure

At the lowest noise levels there is no effect on birds, fish or underwater mammals. As noise levels increase the effect ranges from changes in behaviour, temporary threshold shift in hearing (TTS) and permanent threshold shift in hearing (PTS) through to barotrauma injury and death.

Potential effects on behaviour include impacts on ability to communicate, detection of predators and prey and may be on the individual and/or at the population level. In response to anthropogenic sound, fish have been observed to change swimming behaviour and produce a startle reaction, although under repeated exposure to similar sounds habituation has also been observed [1].

Hearing loss may be temporary, producing a TTS or permanent producing a PTS. These threshold shifts are increases in the threshold of audibility of sound which is the minimum sound pressure level of a sound that is able to evoke an auditory sensation. A TTS is a

reversible shift resulting from a temporary change in sensory hair cells or damage to the auditory nerves.

Barotrauma underwater is a result of rapid pressure changes that produce tissue injury. The pressure changes can cause blood gases to come out of solution or produce rapid changes in gas volumes damaging surrounding tissue. The effects can lead to lethal injury of delayed mortality depending on the severity of the pressure change and the sensitivity of the animal. In some cases, although not directly producing lethal injury itself the barotrauma effect can be to decrease fitness leaving the animal vulnerable to predation or disease.

5 Sound exposure guidelines

DMRB [4] states that it is well-known that colonies of geese thrive near airfields where the advantages of relative seclusion overcome the disturbance due to noise, but that ducks appear to be more sensitive to aircraft noise. The manual reports on Dutch research that show that the effects of traffic noise have increased impact at levels above 45dB L_{Aeq} for a range of woodland, marsh and grassland species. It also states that the threshold of sensitivity to traffic noise of coot was 60dB.

Data on mortality and recoverable injury is provided in [1] for underwater piling noise for fish with no swim bladder as follows:

- Mortality and potential mortal injury arises at levels > 219dB SEL_{cum} or >213dB peak
- Recoverable injury arises at levels >216 SEL_{cum} or >213dB peak
- TTS arises at levels >>186dB SEL_{cum}
- The risk of a behavioural change is high in the near field (tens of metres), moderate in the intermediate field (hundreds of metres) and low in the far field (thousands of metres)

The criteria are presented as sound pressure levels and not as particle velocity levels because no data exists on the sensitivity to particle motion. It is noted that the criteria are expressed in terms of inequalities that are interpreted to mean that the effect level arises at a level either higher or considerably higher than the specified level. It is notable that the same criteria are applied for both recoverable and mortal injury for peak levels and that the difference for cumulative levels is only 3dB. In terms of the 10log(N) factor for repeated, similar events, this factor of 3 amounts to a doubling of the exposure.

Data on Phocid pinnipeds in provided in [3] for impulsive sounds (such as may be produced by impact piling) is as follows:

- PTS for impulsive sound 218dB peak, 185dB LE,PW
- TTS for impulsive sound 212dB peak, 170dB LE,PW

6 Noise produced by piling

BS5228-1 includes estimates of the noise at piling at a distance of 10m and a simple propagation model for larger distances. Sound levels for piling activity are typically in the range 80dB to 89dB L_{Aeq} at 10m depending on the equipment used. Using the attenuation model described in Section 3, above this leads to a sound pressure level range of 44dB to 53dB L_{Aeq} at 600m (approximate distance from piling to the SPA) and 50dB to 59dB L_{Aeq} at 310m (approximate distance from piling to the Old Harbour/Outer Humber Basin mudflats)

Historical data for underwater piling noise at a range of distances is given by DECC [8] and be used together with the attenuation model described above to produce a simple model, based on linear regression, for the sound pressure level at a nominal 1m from the acoustic centre of a source as a function of pile diameter. This leads to piling noise levels given in the box below:

Source levels i.e. level 1m from (conceptual) acoustic centre

Impact piling L_{peak}: SL = 224.5 + 6.48D dB re 1μPa

Impact piling SEL_{ss}: SL = 205.3 + 6.24D dB re 1μPa^{2}s

D is pile diameter [m], r is distance from seat of pile [m]

For piles with a diameter of 1.2m this leads to levels of 192dB L_{peak} and 173dB SEL_{ss} at a distance of 250m (approximate maximum distance from the piling to the lock gates). For cumulative piling with, say, 1000 impacts the SEL_{cum} is 203dB.

The weighting function adjustment for Phocid pinnipeds is an attenuation of approximately 2dB so the $L_{E,PW}$ is approximately 201dB.

7 Assessment

The airborne noise due to piling is estimated to be in the range 44dB to 53dB L_{Aeq} at a distance of 600m. This range of levels span the value of 45dB L_{Aeq} at which increasing impact has been observed from road traffic noise [4] for marsh bird species. The Extrium England Noise Map viewer [9] shows the noise from the A63 is approximately 55dB L_{Aeq} at a distance of 200m from the highway. Using a simple 10log(R/200) model for highway noise to find the noise level at any other distance R [m], the highway noise at 600m is estimated to be approximately 50dB which is lower than the level of noise that the piling is expected to produce. It follows that while piling noise is likely to be audible to the birds above the sound of the highway the piling noise is actually at a lower level so is unlikely to cause disturbance.

It is also helpful to compare the predicted piling noise level to the noise level that may be expected from road traffic noise on the SAC/SPA/Ramsar mudflats 310m away. The Extrium England Noise Map viewer [9] shows the noise from the A63 is in the range 55dB

to 60dB L_{Aeq}. At the Old Harbour/Humber Dock Basin the Extrium map shows road traffic noise level of 55dB to 60dB $L_{Aeq.}$ This is comparable to the expected noise levels from piling at this location which is in the range 50dB to 59dB. Piling noise is therefore likely to be audible at this location but also unlikely to cause disturbance.

The values for the underwater noise produced by piling may be compared with the sound exposure guidelines and with the assumption that lamprey are able to move away from the noise source but only as far as the lock gates. (It may be expected that if they are able to move away from the source they would do so.) Using the sound exposure guidelines from [1] the effects are anticipated to be as follows:

- Mortality and mortal injury: the exposures are below the lower bound for these effects and therefore mortal injury is not expected for fish at the lock gates. At shorter distances the risk of mortality or mortal injury increases
- Recoverable injury: the exposures are below the lower bound for these effects and therefore recoverable injury is not expected for fish at the lock gates. At shorter distances the risk of recoverable injury increases
- TTS: the level is above the lower bound threshold for TTS to arise but it is noted that the double inequality symbol implies that the specified level is very precautionary.

The values for the underwater noise produced by piling may also be compared with the sound exposure guidelines for seals again with the assumption that they are able to move away from the noise source but only as far as the lock gates. Using the sound exposure guidelines from [3] the effects are anticipated to be as follows:

- The peak level of 192 dB is below the threshold for PTS but the cumulative noise exposure of 201dB is 17dB above the threshold. Although a single strike would not lead to a TTS for a seal, several such strikes would lead to this effect: any seals trapped within the marina would probably find underwater piling noise distressing.
- The peak level is also below the threshold for TTS. However, even a single strike is above the TTS threshold, indicating again that any seals unable to escape from the marina would find the underwater noise distressing.
- It is not known if, under these circumstances, the seals would rise above the surface to escape from the noise.

8 Conclusions

The assessment shows:

- Wading birds 600m away and if present in the Old Harbour/Outer Humber Basin mudflats 310m from the piling and already exposed to the noise from the A63 are unlikely to be affected by piling noise.

- Lamprey unable to escape from the marina would be unlikely to be subject to injury

- Any seals unable to escape from the marina would be likely to suffer a temporary threshold shift, and under sustained piling, a permanent threshold shift. Potential impact on individuals or very low numbers would not have a significant effect on the favourable conservation status of grey seals, birds or lamprey as qualifying features. (Notwithstanding this, survey for grey seals will be undertaken to minimise potential for any effect whatsoever prior to piling commencing, in line with good nature conservation practice).

9 References

1 A N Popper et al., Sound exposure guidelines for fishes and sea turtles, ASA S3/SC1.4 TR-2014, Springer, 2014

2 A Franco et al., Assessment of potential impacts of Able Marine Energy Park on sea and river lamprey in the Humber Estuary, University of Hull, 2011

3 NOAA Technical Memorandum NMFS-OPR-55, Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing, National Oceanic and Atmospheric Administration, US Department of Commerce, National Marine Fisheries Service, July 2016

4 Design Manual for Roads and Bridges, HD 213/11, Volume 11 Section 3 Part 7 Environmental Assessment Techniques, Noise and Vibration.

5 BS5228-1 Code of practice for noise and vibration control on construction and open sites, part 1: noise, 2014.

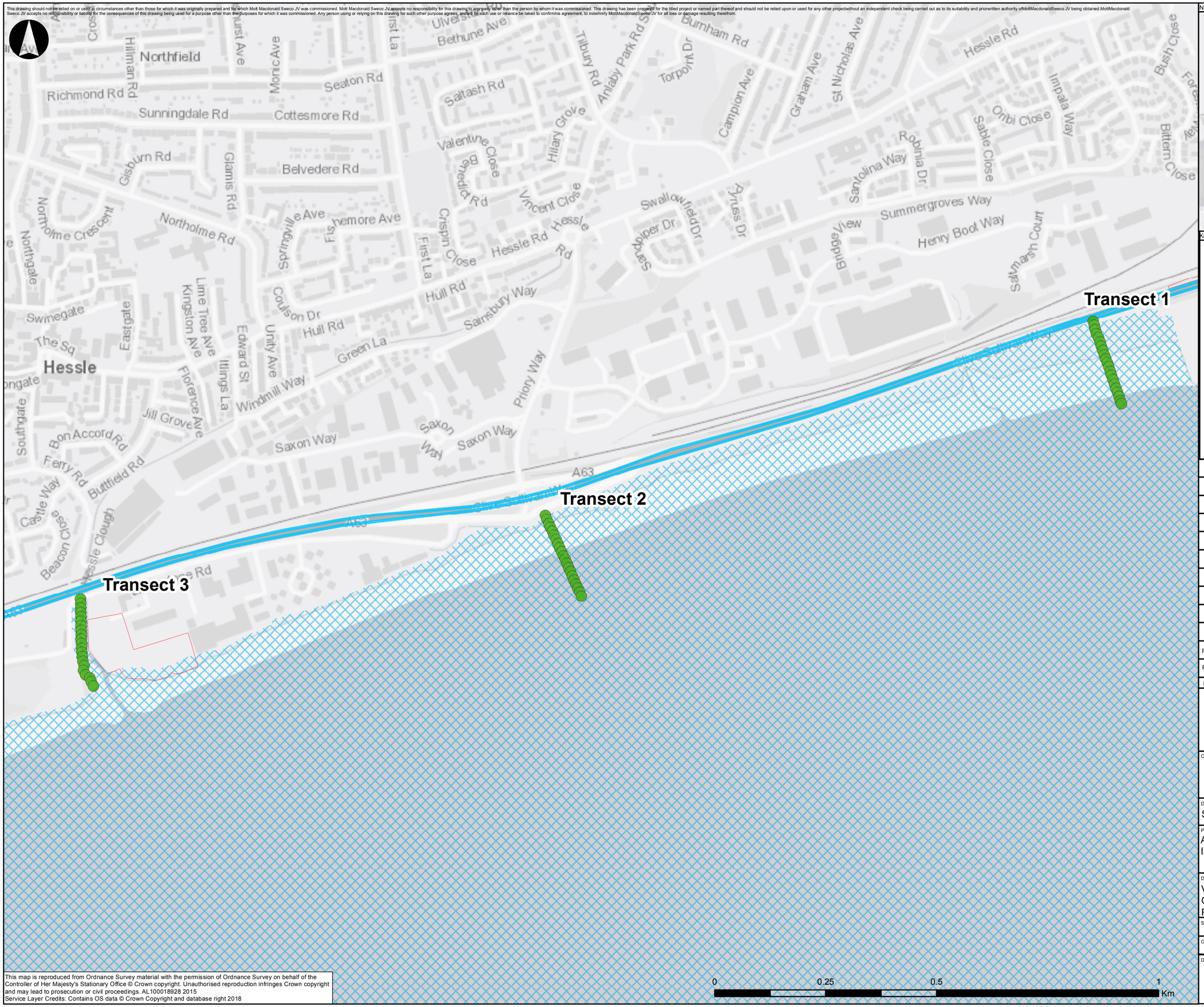
6 The NMFS user spreadsheet that enables the PTS frequency weighting correction to be found from a range of activities is at http://www.nmfs.noaa.gov/pr/acoustics/Acoustic Guidance Files/march_v1.1_blank_spreadsheet.xlsx

7 ABP Mer, Associated British Ports Green Port Hull D136322 Volume 1: Environmental Statement Chapter 12 Marine Ecology and Nature Conservation, November 2011.

8 Department of the Energy and Climate Change (DECC) (2011) Review and Assessment of Underwater Sound Produced from Oil and Gas Sound Activities and Potential Reporting Requirements under the Marine Strategy Framework Directive Genesis Ref: J71656 Document No. J71656-Final Report –G2, July 2011

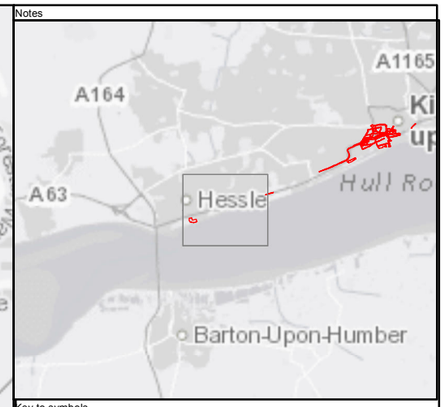
9 Extrium England Noise map viewer at http://www.extrium.co.uk/noiseviewer.html

Appendix G: Air Quality Modelled Receptor Locations



0 0.25 0.5 1 Km

Notes



Key to symbols

- Ecological receptors
- Scheme boundary
- Local affected road network
- Humber Estuary - SSSI, SAC, SPA, Ramsar

Rev	Date	Amendment Details	Drw'n	Chk'd	App'd
P02	28/06/2018	Updated RLB	WF	JAB	JM
P01	25/04/2018	First draft	WF	JAB	JM

Mott MacDonald Sweco

Client: highways england

Drawing Status: SHARED

Suitability: S4

Project Title: A63 CASTLE STREET IMPROVEMENTS, HULL

Drawing Title: VOLUME 2 FIGURE 6.6 OPERATION PHASE : MODELLED RECEPTOR LOCATIONS (ECOLOGICAL)

Scale	Designed	Drawn	Checked	Approved
1;8,000	--	WF	JAB	JM
Original Size	**Date**	**Date**	**Date**	**Date**
A3	--	28/06/2018	28/06/2018	28/06/2018

Drawing Number: HE PIN 514508 - MMSJV - EAQ | Originator | Volume
SO - DR - LA - 000028
Location | Type | Role | Number

Project Ref. No.: 514508

Revision: P02

FILE LOCATION: F:\U2013\proj\115436 A63 Castle Street EA\20_Environment\Landscape\04 Deliverables\04 GIS\MXD_Fig\Air Quality\Figure 6.6 - Operation Phase_Modelled Receptor Locations (Ecological) - P02.mxd